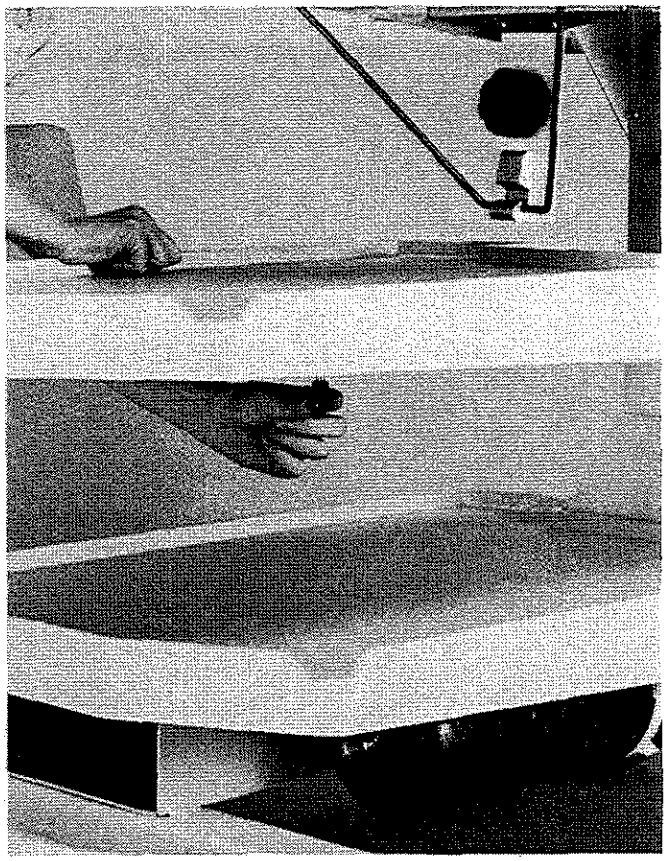


FIGURE 2.23 RELEASING MIDDLE CART SHELF (ACCESSORY)

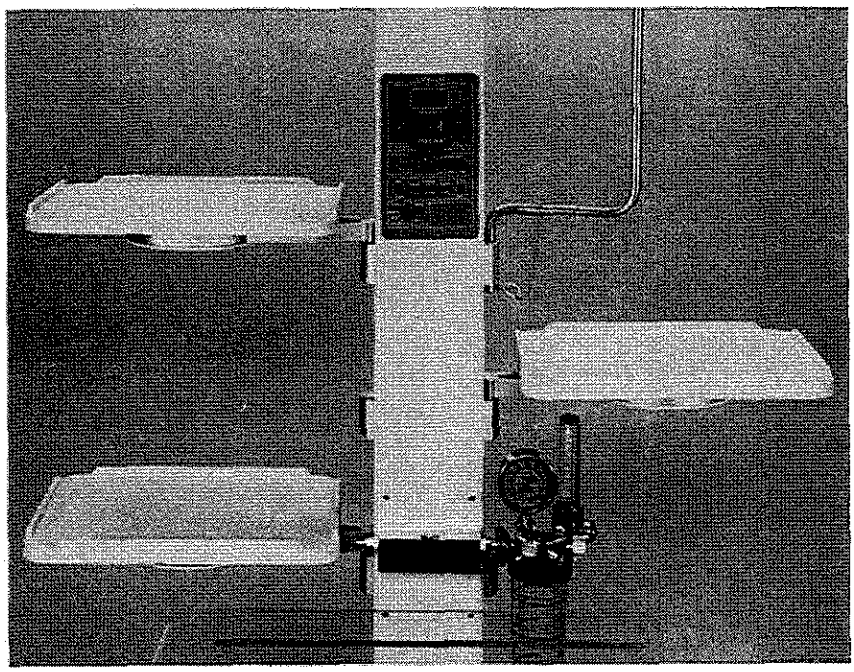


FIGURE 2.24 MONITOR SHELVES (ACCESSORY)

2.7 CLEANING

The equipment should be cleaned as necessary using the procedures given in Section 4 of this manual.

SECTION 3
TECHNICAL INFORMATION

3.1 SPECIFICATIONS

Specifications for the equipment are provided below. All specifications are subject to change without notice.

TABLE 3.1 SPECIFICATIONS

BASIC EQUIPMENT	
POWER REQUIREMENTS:	
100V Model	100 Vac, 50/60 Hz, 680W
110/120V Model	110/120 Vac, 50/60 Hz, 680W
220/240V Model	220/240 Vac, 50/60 Hz, 680W
OVERLOAD PROTECTION:	
100V and 110/120V Models	Two 10A circuit breakers (see Note 1)
220/240V Models	Two 5A circuit breakers (see Note 2)
NOTE 1: Changed to single 10A circuit breaker and then to single 13A circuit breaker in later production.	
NOTE 2: Changed to two 7A circuit breakers in later production.	
CHASSIS LEAKAGE CURRENT	Less than 100 µA
EXAMINATION LIGHT ILLUMINANCE	100 foot candles (nominal) at mattress center
ALARMS:	
PROBE FAIL	Actuates if Skin Probe is open, shorted, unplugged, or if the skin temperature reaches 39.0 °C
SET POINT	Actuates if the skin temperature deviates 1.0 °C from the set point temperature for longer than 14–20 seconds
POWER FAIL	Actuates when there is a loss of power
SILENCE/RESET Switch Malfunction	Actuates after 15 seconds if SILENCE/RESET Switch malfunctions or is held depressed for longer than 15 seconds
SKIN TEMPERATURE SET POINT RANGE	34.0 °C to 37.9 °C
SKIN TEMPERATURE DISPLAY:	
Accuracy	± 0.2 °C
Type	Digital LED with 0.1 °C resolution
Correlation of Displayed Temperature to Skin Temperature	± 0.2 °C

(Change 11)

TABLE 3.1 SPECIFICATIONS (CONT.)

BASIC EQUIPMENT	
SKIN TEMPERATURE VARIABILITY AT TEMPERATURE EQUILIBRIUM	0.2 °C
MANUAL HEAT CONTROL	Fully adjustable from zero to maximum heater power (560W nominal)
WARMER MODULE SWIVEL (Not provided on Free Standing Warmer)	65° either side of center position
NOMINAL DIMENSIONS – INFANT INTENSIVE CARE SYSTEM	
Height (Maximum)	77 inches (195.6 cm)
Height (Alternative lower position)	74.75 inches (189.9 cm)
Width (With Warmer Module in Center position)	28 inches (71 cm)
Depth	43 inches (109.22 cm)
Mattress Width	21 inches (53.34 cm)
Mattress Length	26 inches (66.04 cm)
Weight	185 lbs (84 kg)
Warmer Module Swivel	65° either side of center position
Mattress Height (High position)	39 inches
Mattress Height (Low position)	36.75 inches
NOMINAL DIMENSIONS AND WEIGHT – FREE STANDING INFANT WARMER	
Height (Maximum)	77 inches (195.6 cm)
Height (Intermediate position)	74 inches (188 cm)
Height (Low position)	71 inches (180 cm)
Height of Base	3.5 inches (9 cm)
Width (Maximum)	28 inches (71 cm)
Depth	38.5 inches (98 cm)
Weight	103 lbs (47 kg)
NOMINAL DIMENSIONS AND WEIGHT – WALL MOUNTED INFANT INTENSIVE CARE SYSTEM	
Height (Unmounted)	59 inches (150 cm)
Width (With Warmer Module in Center Position)	22 inches (56 cm)
Depth (Including Wall Bracket)	46 inches (117 cm)
Weight	124 lbs (56 kg)
NOMINAL DIMENSIONS AND WEIGHT – WALL MOUNTED INFANT WARMER	
Height (Unmounted)	53 inches (135 cm)
Width (With Warmer Module in Center Position)	12.5 inches (31.75 cm)
Depth (Including Wall Bracket)	38 inches (97 cm)
Weight	44 lbs (20 kg)
Warmer Module Swivel	65° either side of center position

TABLE 3.1 SPECIFICATIONS (CONT.)

BASIC EQUIPMENT
ENVIRONMENTAL:
Ambient Operating Temperature ..... 68 °F (20 °C) to 86 °F (30 °C)
Humidity ..... 0 to 95%
Vibration and Shock ..... Normal nursery handling
Altitude ..... Sea level to 1.9 miles (3 km)
ACCESSORIES
OXYGEN DELIVERY SYSTEM REQUIREMENTS:*
Oxygen From Wall Source ..... 50 psi nominal
Oxygen From Cylinder ..... up to 2500 psi
MONITOR SHELF LOADING* ..... up to 40 lbs (18 kg) per shelf or 50 lbs (22.7 kg) per side total
CART SHELF LOADING** ..... up to 50 lbs (22.7 kg) per shelf
PHOTOTHERAPY SYSTEM ..... 9µW/cm²/nm (Nominal light energy output at center mattress, 400–500 nanometer wavelength)
*Infant Intensive Care System and Wall Mounted Infant Intensive Care System Only.
**Infant Intensive Care System Only.

3.2 THEORY OF OPERATION

3.2.1 GENERAL

This section contains a system functional description of the equipment and detailed Theory of Operation of the Controller and Power Module used in the equipment. A system block diagram is shown in Figure 3.1.

3.2.2 SYSTEM FUNCTIONAL DESCRIPTION

WARMER MODULE

The radiant heat from the vented hood is directed by parabolic reflectors onto the bassinet mattress with minimum discomfort to attending personnel. The Warmer is controlled by a single Controller which provides either manual heater control or automatic skin temperature control. Located in the Warmer Module is an examination light which is controlled by a switch on the front of the Warmer Module. The examination light provides added illumination of the mattress area.

CONTROLLER

When operated in the Manual Control Mode, the Controller permits the heat output of the Warmer Module to be adjusted from zero to maximum settings. When operated in Skin Temperature Control Mode, the Controller utilizes a Skin Temperature Probe connected between the Controller input and the infant to automatically adjust the heat output of the Warmer Module to maintain a desired preset skin temperature. Thumbwheel switches permit adjustment of skin temperature set point and a digital display provides temperature readout.

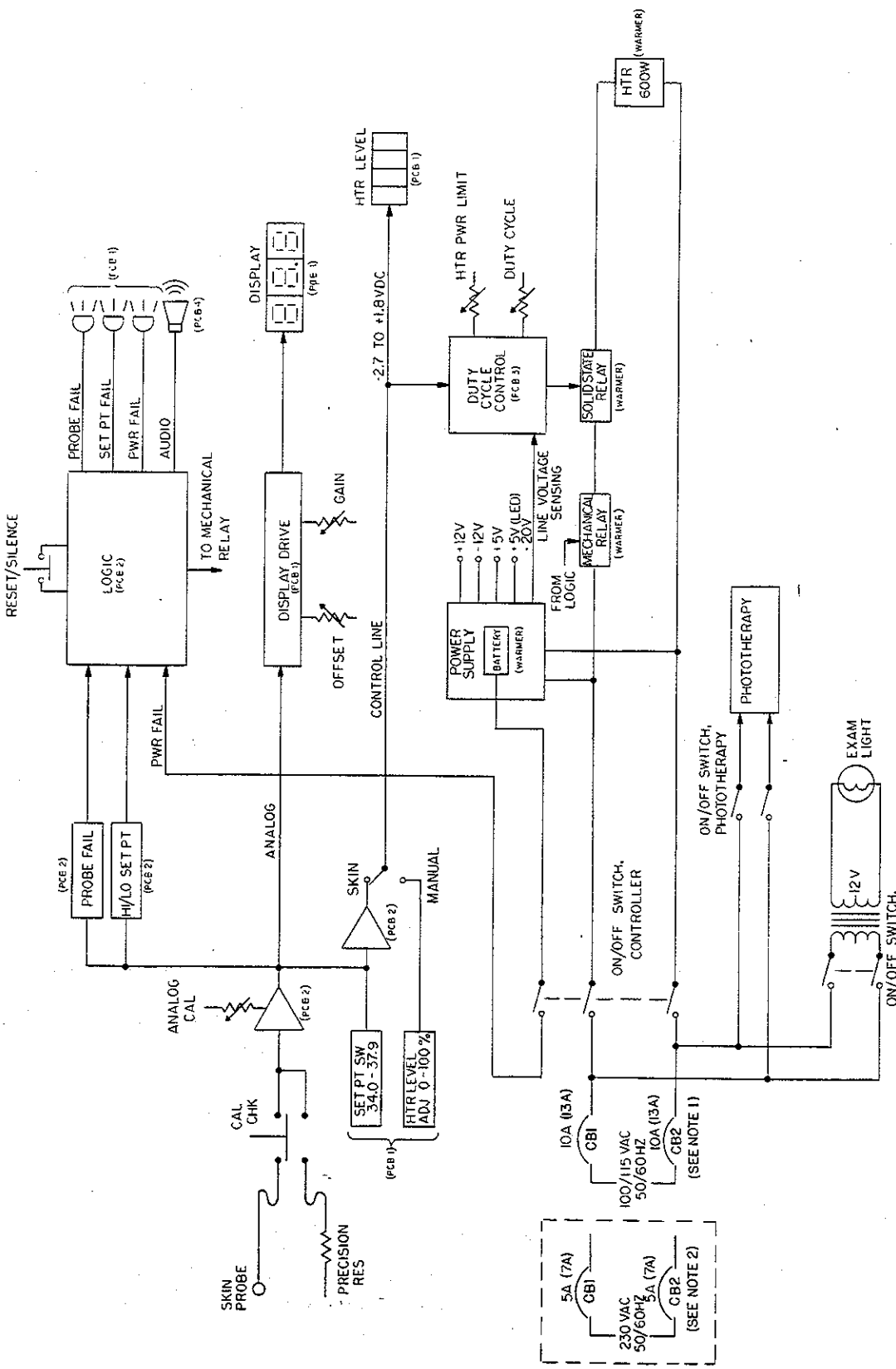
ALARMS

Each time the unit is turned on, an automatic test sequence is initiated to verify that the visual displays and the audible alarm are functional. Alarms are provided for power failure, high and low skin temperature (when in Skin Temperature Control Mode); probe failure and unplugged probe, SILENCE/RESET switch malfunction, and manual alert when in Manual Control.

POWER FAIL. If power to the unit is interrupted for any reason, the POWER FAIL indicator will light and the audible alarm will sound continuously. When power is restored, the alarm circuit is self–resetting.

SET POINT (HIGH). If the temperature sensed by the skin probe is 1 °C above the set point temperature, a high SET POINT alarm will occur after a 14–20–second delay. The SET POINT indicator will flash, a continuous audible alarm will sound and the heater is turned off. In Model CM78–1, this alarm cannot be reset until the alarm condition is corrected. In Model CM78–2, the audible portion of the alarm can be silenced by depressing the SILENCE/RESET Switch; however, the indicator will continue to flash. If the condition is not corrected within 14–20 minutes, the audible alarm will resume. When the alarm condition is corrected, the circuit will automatically reset. The SILENCE/RESET Switch must be actuated to turn off the steady ALARM light.

(Change 11)



NOTE 1. CB1 AND CB2 ARE 10A THEN CHANGED TO 13A (FIRST PRODUCTION). CB2 REMOVED IN LATER PRODUCTION.

NOTE 2. CB1 AND CB2 CHANGED TO 7A IN LATER PRODUCTION.

FIGURE 3.1 SYSTEM BLOCK DIAGRAM

NOTE: If not manually reset when the sensed temperature returns to set point and the temperature falls to 0.5 °C below set point, the system changes to a low set point alarm condition and the heater turns on again. The alarm indications will now cease if the sensed temperature returns to set point (see SET POINT (LOW) which follows).

SET POINT (LOW). If the temperature sensed by the skin probe is 1 °C below the set point temperature, a low set point alarm will occur after a 14–20–second delay. The SET POINT indicator will flash, a one–second on/one off chirping alarm will sound, but the heater will remain on. The audible portion of the alarm can be silenced by depressing the SILENCE/RESET Switch; however, the indicator will continue to flash. If the condition is not corrected within 14–20 minutes, the audible alarm will resume. When the alarm condition is corrected, the circuit will automatically reset (i.e the audible alarm will cease and the light will remain on but cease to flash). The SILENCE/RESET must be actuated to turn off the steady ALARM Light.

During initial warm–up of the infant, if the infant's skin temperature is more than 1 °C below the SET TEMP, the visual SET POINT alarm will flash but the audible alarm is automatically silenced for the first 14–20 minutes of warm–up or until the skin temperature is within 1 °C of SET POINT, whichever is shorter. After the initial 14–20 minute period, the low SET TEMP alarm returns to normal function.

NOTE: The SILENCE/RESET switch must be depressed for at least 2 seconds after the audible signal is silenced to allow internal circuitry to reset. Failure to do so could result in alarm reactivation.

PROBE FAIL. If the skin temperature probe is open, shorted, or unplugged, a probe alarm will occur after a 14–20–second delay. The display will blank, the PROBE FAIL alarm indicator will flash, a one–second on/off chirping alarm will sound, and the heater will be turned off. This alarm cannot be reset until the alarm condition is corrected. The PROBE FAIL alarm will also sound if the skin temperature reaches 39.0 °C. When the PATIENT PROBE is used for monitoring during MANUAL Control, the PROBE FAIL alarm will not be activated in the event of a PATIENT PROBE failure or if it is unplugged.

SILENCE/RESET SWITCH MALFUNCTION. If the SILENCE/RESET switch malfunctions, a continuous audible alarm will sound after a 15–second delay. The alarm will also sound if the switch is held depressed for more than 15 seconds. This alarm cannot be reset until the alarm condition is corrected.

MANUAL: After 9 to 13 minutes of operation, a one–second audible tone (Manual Alert) will sound every 30 seconds. The heater may be reset for an additional 13 to 19 minutes without the heater turning off by pressing the SILENCE/RESET switch. If the circuit is not reset, the heater is automatically turned off when 13 to 19 minutes of continuous operation have elapsed, the MANUAL indicator light goes off, and a one–second on/off chirping alarm is activated.

NOTE: The SILENCE/RESET switch must be depressed for at least 2 seconds after the audible signal is silenced to allow internal circuitry to reset. Failure to do so could result in alarm reactivation.

POWER MODULE

The Power Module plugs into the Warmer Module. A detachable power cord supplies line voltage to the Power Module and overload protection is provided by circuit breaker(s). The Power Module supplies power to the Controller by means of a plug–in ribbon cable located in the warmer housing.

The Power Module also provides power to the phototherapy connectors, examination light, and warmer heating element in the warmer housing.

(Change 11)

3.3 DETAILED CIRCUIT DESCRIPTION

The following paragraphs contain detailed circuit descriptions of the following components of the equipment.

- Warmer Module
- Power Module
- Controller

3.3.1 WARMER MODULE

Refer to Figures 7.1 and 7.1A. The Warmer Module contains a 600 watt quartz heater (HTR1) that provides radiant heat for infant warming. The heater is contained in a vented hood and the radiant heat is directed onto the mattress by a parabolic reflector. The Warmer Module also contains the examination light and connectors for the optional Phototherapy Attachment.

Power for the Warmer Module is supplied by the Power Module (para. 3.3.2) which plugs into the warmer housing. The interconnection is made through connector J2. The WARMER ON–OFF switch (S1) controls application of ac power to the Power Module which supplies dc power to the Controller (para. 3.3.3). The Controller, in turn, controls heater power. The EXAMINATION LIGHT ON–OFF switch (S3) and transformer T2 supply power to the examination light (DS1). The PHOTOTHERAPY ON–OFF switch (S2) controls application of power to the phototherapy connectors (J11 and J12).

3.3.2 POWER MODULE

Refer to Figures 7.1 and 7.1A. The Power Module plugs into the Warmer Module through connector J2 and supplies all ac and dc power to the equipment. Primary ac power is applied through a detachable power cord to ac input connector J1. Circuit breaker(s) provide overload protection for the ac line.

When the WARMER ON–OFF switch (S1) on the Warmer Module is set to the ON–1 position, power is applied to the primary winding of power transformer T1 through connectors J2, J5, and J6. Transformer T1 has two secondary windings, one feeds bridge rectifier CR3 and the other feeds rectifiers CR5 and CR6. The positive (+) output of CR3 feeds voltage regulators VR1 and VR2 which in turn, produce regulated outputs of +12 Vdc and +5 Vdc, respectively. These outputs are fed to J10–5 and –6 and J10–17 and –18. CR3 also produces an unregulated +20 Vdc output at J10–9. The negative (–) output of CR3 produces an unregulated –20 Vdc output at J10–10 and, in conjunction with voltage regulator VR3, a regulated –12 Vdc output at J10–15 and –16. Filtering for these circuits is provided by capacitors C1 through C5.

Rectifiers CR5 and CR6 produce an unregulated +5 Vdc output at J10–3 and –4. Filtering for this circuit is provided by capacitor C6.

Solid state relay (SSR) K2 controls heater power during operation. The relay is actuated by the signals SSR HI (J10–7) and SSR LO (J10–8) which are generated on the Controller Control Board PCB3.

Relay driver Q1 and relay K1 are activated by the signal RELAY DRIVE (J10–20). The control signal is generated on PCB2. The circuit provides a redundant means of cutting off power in the event of an alarm.

Battery BT1 and associated components provide the voltage necessary to activate the POWER FAIL alarm in the event of primary power failure.

3.3.3 CONTROLLER

DISPLAY BOARD – PCB1

The Display Board, PCB1, contains the digital readout for skin temperature, alarm indicators, heater output indicators, control mode indicator and switches for calibration, reset and control mode. Refer to Figure 7.2.

TEMPERATURE DISPLAY

The analog signal inputs from the Measurement/Digital Board, PCB2, are converted to the digital signals needed to drive the seven segment LED displays, DS1 through DS3, by the A/D converter U1. The A/D converter includes auto zero and current limiting for the LED drivers. The number of readings per second is determined by the RC network R6 and C4 which gives approximately one reading per second. C3 is a bypass capacitor and is used to reduce noise in the voltage reference circuit. The RC network R5, C1 and C2 is used to provide proper operation of the auto zero and integrator circuits in the A/D converter.

The sensitivity of the A/D converter is determined by the voltage reference at pin 36. Resistor network R11 and R12 sets the voltage reference at a nominal 2.0 volts which will provide a sensitivity of 200 mV per °C. Trimpots R2 and R7 set the converters offset and gain, respectively.

The diode network CR1, CR2, and CR3 is used to provide display blanking when the input voltage is outside the permissible limits caused by the temperature measuring thermistor being either open or shorted.

The lamp test function is provided by U4 which drives pin 37 of the A/D converter high, lighting all the display segments and giving a reading of 88.8. Note that the decimal point is driven through R1 at all times, so the decimal point is lighted, even when the line input range is exceeded, blanking the display.

The A/D converter uses the system +5V supply and a –5V supply derived from a unity gain inverting op amp which insures power supply tracking. The LED supply is obtained from a separate high current +5V supply.

CONTROLS

The CAL CHECK switch, S2, is a momentary pushbutton switch that is used to check the temperature measuring circuit calibration. Depressing this switch inserts a precision resistor, R17, in place of the skin probe and will cause the temperature display to read 36.0 ± 0.1 °C if the circuit is calibrated.

The SILENCE RESET switch, S3, is used to reset various circuits in the Controller as follows:

1. **IN SKIN TEMPERATURE CONTROL MODE**, it performs the following:

   A. Silences low SET POINT alarm for nominally 15 minutes; alarm silence is automatically over–ridden if another alarm occurs within the period of silence.

   B. Resets PROBE FAIL alarm only after the condition is corrected.

   C. In Model CM78–1 resets high SET POINT alarm only after the condition is corrected.

   D. In Model CM78–2 silences high SET POINT alarm for nominally 15 minutes; alarm silence is automatically overridden if another alarm occurs within the period of silence.

2. **IN THE MANUAL CONTROL MODE**, it performs the following:

   A. Resets the manual control timer after 10 minutes of expired time.

B. Resets manual control timer, silences alarm, and restores heater power after 15 minutes of expired manual control.

The CONTROL MODE switch, S1, is a three section switch which controls the following:

1. **SWITCH SECTION S1–A** controls the selection of the SKIN control mode indicator, DS4, or MANUAL control mode indicator, DS5.

2. **SWITCH SECTION S1–B** controls the selection of either the manual or skin control circuitry on the Measurement/Digital Board PCB2 (refer to Figure 7.3).

3. **SWITCH SECTION S1–C** serves as a manual switching point for logic levels used by various control circuits on the Measurement/Digital Board PCB2 (refer to Figure 7.3).

The MIN–HEAT–MAX control, R35, provides the means for adjusting heater output in the manual mode of operation. The control permits adjustment of heater power from zero to maximum.

The SKIN TEMP °C thumbwheel switches, S4, are used to select set point temperature during skin mode of operation. The binary coded decimal switches interconnect with binary weighted resistors on the Measurement/Digital Board PCB2 (refer to Figure 7.3) to control the set point temperature. The switches have mechanical stops to limit the setting of the set point to between 34.0 °C and 37.9 °C.

INDICATORS

The SKIN Control Mode indicator, DS4, lights when operating in skin temperature control mode. The MANUAL Control Mode indicator, DS5, flashes continuously when operating in manual control mode. The MANUAL Control Mode indicator may be switched off by a signal from PCB2.

The HEATER level indicator, DS6, is a four segment LED that provides a relative indication of heater output. The indicator segments are driven by a quad comparator, U3, so that the heater output is indicated in discrete steps. The number of lamps illuminated indicates the relative heater output.

The SET POINT alarm indicator, DS8 and U2, flashes and a continuous audible alarm occurs when the skin temperature deviates ± 0.5 °C from the set point temperature for longer than 15 seconds. If the temperature returns to within 0.5 °C of set point, the alarms are reset as follows:

Low Temperature Alarm: Resets automatically.

High Temperature Alarm: Must be manually reset (CM78–1).

High Temperature Alarm: Resets automatically (CM78–2).

If the Model CM78–1 is not manually reset when sensed temperature returns to set point, and temperature falls to 0.5 °C below set point, alarm system changes to a low set point alarm condition and heater turns on again. Alarm indications will now cease if sensed temperature returns to set point.

The PROBE FAIL alarm indicator, DS7 and U2, flashes and a continuous audible alarm sounds to indicate an open probe, shorted probe, unplugged probe, or skin temperature above 39.0 ± 0.5 °C. After a 15–second delay, the heater is shut down. After the condition is corrected, the RESET button must be depressed to turn off the indicator, silence the alarm, and restore heater power.

The POWER FAIL alarm indicator, DS9 and Q2, lights continuously and an audible alarm occurs when there is a loss of power. The circuit is powered by a battery, BT1, in the Power Module. The alarm is self–resetting with the resumption of power.

MEASUREMENT/DIGITAL BOARD – PCB2

ANALOG SECTION

The analog section of PCB2 consists of six separate circuits. Refer to Figure 7.3.

The first circuit is the patient probe thermistor amplifier, U1 pins 1, 2, and 3. This is a nonlinear inverting circuit which combines the temperature versus resistance characteristic of the patient probe thermistor (T1) with a fixed reference voltage to produce an almost perfectly linear voltage versus temperature output. The output voltage is fed to J2–14 and rises nominally 200 mV/ °C from 0–volts at 20.0 °C to 4.0 volts at 40.0 °C.

The output of the thermistor amplifier is fed to the probe fail limit comparators, U3, pins 10, 11, 13, and U3 pins 8, 9, and 14. These comparators form a window comparator whose output is high as long as the output of the thermistor amplifier is less than 3.8 volts and greater than –5.0 volts. If the output of this circuit goes low, due to an open probe, shorted probe, unplugged probe, or a probe temperature above 39.0 °C, a PROBE FAIL signal is generated at J2–6.

The set point D to A converter, U1 pins 5, 6, and 7, senses the setting of the thumbwheel switch assembly S4 on PCB1 (refer to Figures 7.2 and 7.5). Switch S4 has a network of binary weighted resistors connected to +5.0 Vdc, and as the number dialed into the thumbwheels is increased, more resistors are connected in parallel with +5 Vdc to J2–1. Therefore, increasing the set point causes a voltage that increases in a negative direction at U1–7.

The set point voltage and the voltage representing temperature are combined in the deviation amplifier, U2 pins 5, 6, and 7. This amplifier sums the voltages and produces an output proportional to set point minus temperature. With the set point fixed, as temperature decreases, the difference voltage at J2–7 increases.

This voltage also feeds a set of limit comparators, U3 pins 1, 6, 7, and U3 pins 2, 4, and 5. This circuit produces a low output at J2–20 if the measured temperature is 0.5 °C below set point, or a low output at J2–24 if the measured temperature is 0.5 °C above set point.

The last analog section is a buffer, U2 pins 1, 2, 3, and associated components. The input is taken from the manual heater control on the display board, PCB1, and the output is fed back to the control board PCB3 where a slide switch selects skin or manual control.

DIGITAL SECTION

The digital logic section is run synchronously by master clocks 0/1 (1 Hz) and 0/2 (1/2 Hz). These signals are generated by U6A and U8A, respectively. Since these clocks are vital to the functioning of the unit, a "dead man" timer formed by U20 pins 8 through 12 detects the absence of a clock signal and activates the audio alarm trigger U6B if the clock signal is not present.

If the silence/reset circuit malfunctions, a continuous audible alarm will sound after a 15–second delay. The alarm will also sound if the SILENCE/RESET switch is held depressed for more than 15 seconds. The signal that triggers the alarm is generated by U9–B which is configured as 15–second timer.

Most of the digital circuitry is involved in the start up test sequence. When power is applied, the start up sequence is coordinated by U15, a one of eight decoder. The start up proceeds as follows:

1. **THE DISPLAY TEST** pin (J2–8) goes high, turning on all the segments in the temperature display.
2. **ANALOG SWITCH U4** is used to simulate an open probe, turning on the probe fail (J2–6 and 27), set point fail (J2–28), low temp. alarm (J2–20), heater power display, and audio (J2–29) alarms; this condition is reset.

3. **ANALOG SWITCH U4** is then used to simulate a shorted probe. This turns on the high temp. (J2–24), probe fail (J2–6 and 27), set point (J2–28), and audio (J2–29) alarms; this alarm is also reset.

4. **THE POWER UP SEQUENCE GENERATOR** (U15) then latches itself in the last state and the unit will function normally.

In the normal (non–start up) mode, any alarm condition (except clock fail) must exist for about 15 seconds before alarms will be activated. This function is performed by U9A and associated components.

When a low temp. alarm is sounded, depressing the silence/reset button will silence the alarm from sounding for 15 minutes by activating counter U10. This circuit will not silence a high temp. alarm.

In addition to the solid state relay which controls the heater power in operation, a safety interlock mechanical relay is powered by U18, pin 4. This relay provides a redundant means of cutting off power in the event of an alarm. This circuit also ensures that the heater power lights are off in this instance (U4 pins 1 and 2).

The logic used to turn the set point and probe fail indicators on comprises U7A and B and associated components; the lights are caused to flash by clock signal 0/2 (J2–26).

Finally, the circuit formed by U6B, U12–U14, U16–U18 is used during the manual mode. When first switched into the manual mode, the manual lamp flashes. After nominally 10 minutes, J2–29 is pulsed high for 1 second by U6–B every 30 seconds, causing a short beep. After five additional minutes, the manual light and the audible alarm are activated continuously and heater power is disconnected by U18.

CONTROL BOARD – PCB3

CONTROL VOLTAGE LIMITER

The function of the voltage limiter is to limit maximum heater output power to approximately 560 watts. As line voltage rises, the power available from the heater goes up by the square of the voltage. The limiter prevents the power from going over the 651 watt limit. Refer to Figure 7.4.

A portion of the unregulated +20 Vdc supply is fed to buffer U1 pins 5, 6, and 7. The output of the buffer is fed to the minus (–) input of summing amplifier U1 pins 1, 2, and 3. The voltage at the plus (+) input (U1–3) is a precision voltage set by the Duty Cycle Limit Adjust control, R6, during calibration. The output of the summing amplifier (U1–1) is fed to a clamp circuit (U1 pins 9, 10, 11, and CR1) which prevents the voltage on J3–12 from rising above the voltage on U1–10. As long as the voltage at J3–12 is less than the voltage at U1–10, the clamp circuit has no effect on operation and the voltage on TP2 (J3–26) equals the voltage on J3–12. At this point, –2.7 volts equals 0% duty cycle and +1.8 volts equals 100% during cycle.

CONTROL AMPLIFIER

The signal CONT.–INPUT on J3–12 represents a weighted error signal (set point temperature). This error signal is applied to a control amplifier, U1 pins 12, 13, and 14.

The error signal at the output of the control amplifier (U1–14) is applied to the minus (–) input of a proportional amplifier (U2–9). At this point, the error signal is inverted and summed with an adjustable offset voltage established at U2–10 by the setting of the Duty Cycle Adjust control R14 which sets the zero reference of the duty cycle controller. The error signal is also ac coupled to an amplifier (U2, pins 12, 13, and 14) which produces a signal proportional to the rate of change of the error signal.

The output signals at U2–14 and U2–8 are summed together by R11/R17 and amplified by U2, pins 5, 6, and 7. At TP3 (J3–26), approximately 0.2 volts equals 0% duty cycle and approximately –1.6 volts equals 100% duty cycle.

DUTY CYCLE CONTROLLER

The duty cycle controller is formed by U2, pins 1, 2, and 3 and associated components. As the voltage on U2, pin 7 decreases, the duty cycle at U2, pin 1 increases. The output of the controller is fed to Q1, which drives the solid state relay (SSR) K2 in the power module.

MOTHER BOARD – PCB4 (Series 00 and 01)

Refer to Figures 7.5 and 7.8. The mother board provides the means for power and signal distribution to PCB1 (J1), PCB2 (J2), PCB3 (J3), set–point switch (J7), and skin probe (J5). A ribbon cable connected to J4 provides the interconnections between the controller and power module.

A thumbwheel switch assembly is connected to J7. Resistors R1 through R8 are used in conjunction with the set–point switch assembly to develop the proper resistance value necessary for PCB2 circuitry.

During normal operation, the audible alarm (DS1) is not driven by the free running oscillator (U1) due to clamping action of peripheral driver (U2). During alarm conditions, U2 allows U1 and its associated discrete components to drive the Piezzo electric transducer (DS1). Under power failure conditions, the clamping action of U2 is inoperative and transducer circuitry is powered by a battery. In Series 01 Models J9 is provided for the attachment of Remote Alarm Module (Accessory). P9, jumper plug, or the Remote Alarm Module must be connected or an alarm will occur.

MOTHER BOARD – PCB4 (Series 02 and Higher)

Refer to Figure 7.9. The mother board provides the means for power and signal distribution to PCB1 (J1), PCB2 (J2), PCB3 (J3), set–point switch (J7), and skin probe (J5). A ribbon cable connected to J4 provides the interconnections between the controller and power module.

A thumbwheel switch assembly is connected to J7. Resistors R1 through R8 are used in conjunction with the set–point switch assembly to develop the proper resistance value necessary for PCB2 circuitry.

During normal operation, the audible alarm speaker (DS1) is not driven by the audio drive circuit due to the clamping action of the peripheral driver U2B. During alarm conditions, U2B allows the alarm drive circuit (U1, U3A and U4) to drive the speaker (DS1). U4A, B C, and associated R9, 10 and C1 form a free running oscillator. U1, U4D and U3A modulate the fundamental frequency to provide a chirping sound with an approximate 1 second ON/OFF period. Volume control R11 will vary the voltage applied to the speaker DS1.

J9 is provided for the attachment of a Remote Alarm Module (Accessory). P9, jumper plug, or the Remote Alarm Module must be connected or an alarm will occur.

(Change 10)

SECTION 4
PREVENTIVE MAINTENANCE

4.1 GENERAL

This section provides preventive maintenance procedures for the equipment. Included are cleaning instructions, sterilization procedures, and a calibration schedule.

WARNING:

- **If oxygen delivery equipment is being used with the equipment, make sure that the oxygen supply to the equipment is turned off and that it is disconnected from the oxygen supply when performing cleaning and maintenance procedures; a fire and explosion hazard exists when performing cleaning and/or maintenance procedures in an oxygen enriched environment.**
- **An electric shock hazard exists when performing cleaning and maintenance procedures; make sure that the power cord is disconnected from the wall receptacle.**

4.2 CLEANING

When an infant is discharged, or at least once a week, the equipment should be thoroughly disinfected. Cleaning of the Infant Intensive Care System and Wall Mounted Infant Intensive Care System can most effectively be accomplished by disassembling, then grouping the parts and/or assemblies in categories according to the method of cleaning required. The Free Standing and Wall Mounted Infant Warmers need not be disassembled for cleaning.

4.3 DISASSEMBLY FOR CLEANING

4.3.1 DISASSEMBLY AND REMOVAL OF BASSINET

1. **TILT THE BASSINET** to the Fowler position as shown in Figure 4.1.

   NOTE: The side, front, and back panels of the Bassinet are mounted identically; therefore, the procedure for removing any or all of these panels is the same.

2. **RAISE THE PANEL** (Figure 4.2) and swing the panel away from the Bassinet.

3. **REMOVE THE PANEL** (Figure 4.3) by grasping the ends of the panel and raising one end of the panel until it snaps free of the detent in the corner mount; slide the other end of the panel out of the corner mount.

4. **REMOVE THE MATTRESS** from the Bassinet.

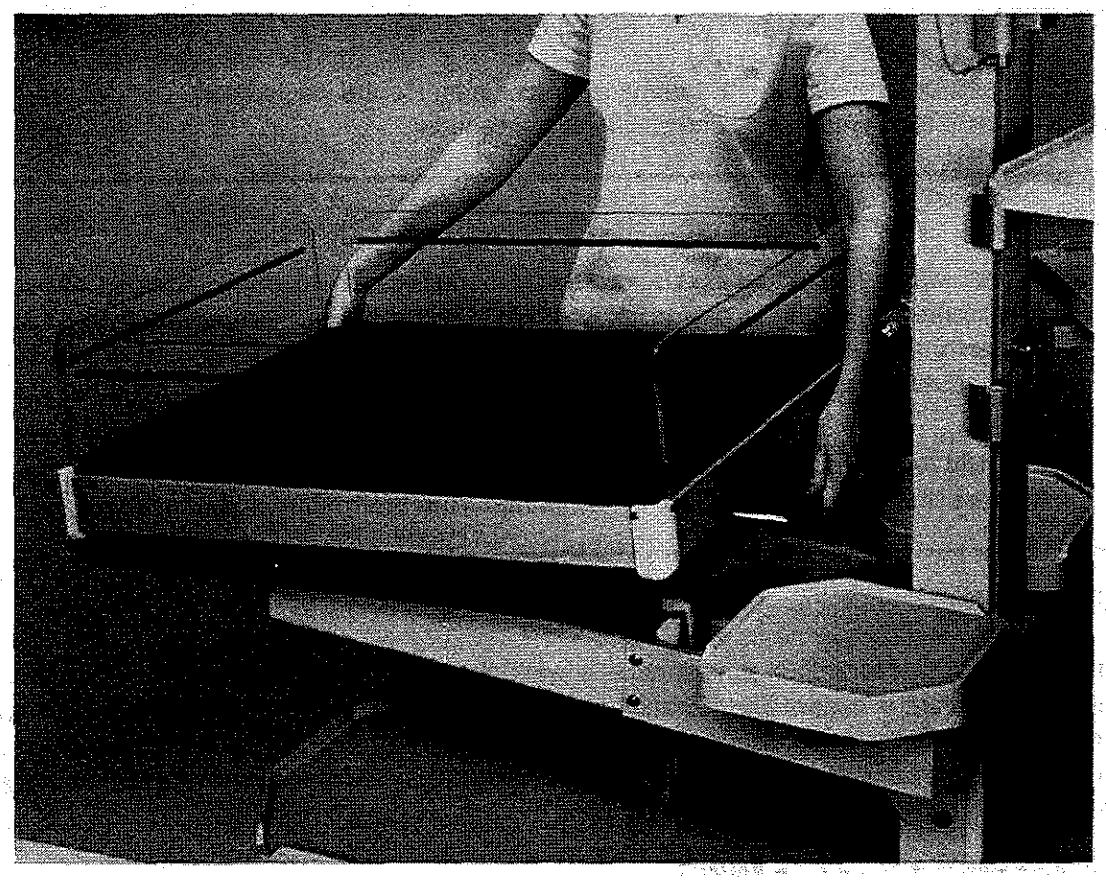


FIGURE 4.1 TILTING BASSINET

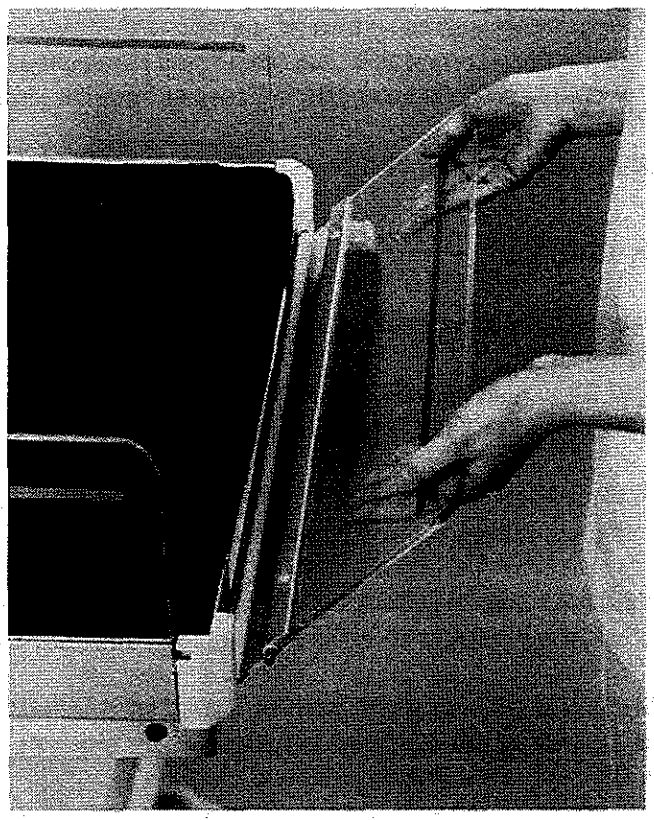


FIGURE 4.2 RAISING SIDE AND END PANELS

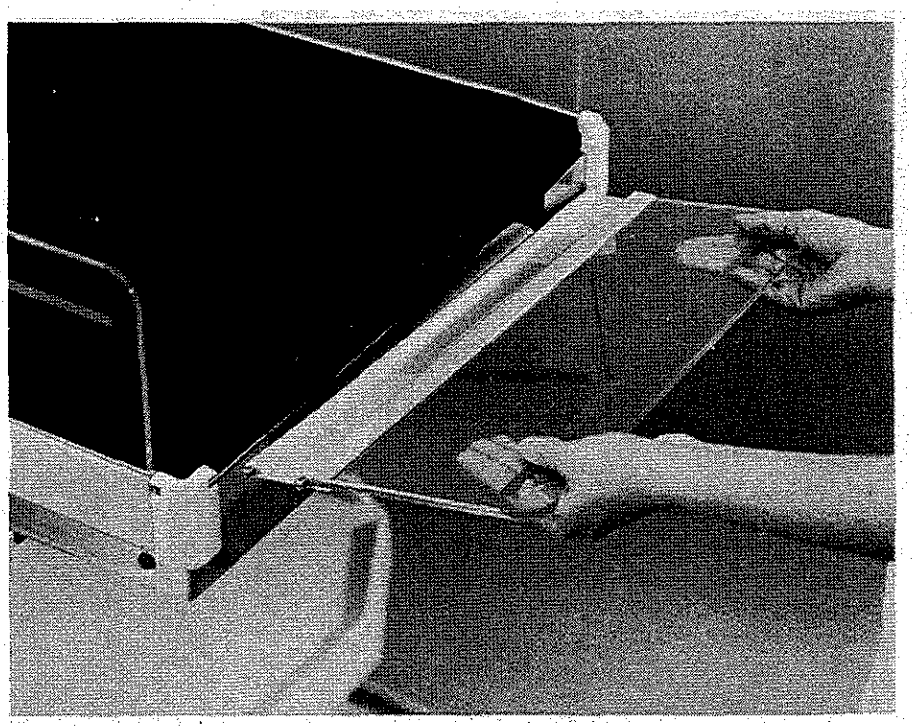


FIGURE 4.3 REMOVING SIDE AND END PANELS FROM BASSINET

5. **REMOVE BASSINET** (Figure 4.4) by grasping the release mechanisms located under the center at each side and pull outward. Lift the Bassinet and tilt it from side to side to release the elevator bar from the two tilt adjusting brackets on the Bassinet Support; lift the Bassinet from the Bassinet Support.

6. **REPLACE THE BASSINET** by reversing the above procedure.

4.3.2 REMOVAL OF CART SHELVES

To remove the Cart Shelves from the Infant Intensive Care System, proceed as follows:

1. **REACH THROUGH THE OPENING UNDER THE FRONT OF THE SHELF** (Figure 4.5, View A) and pull down on the locking knob; slide the Shelf forward until it reaches a positive stop.

2. **REACH THROUGH THE OPENING UNDER THE REAR OF THE SHELF** (Figure 4.5, view B) and pull down again on the locking knob; slide the Shelf forward and off of the unit.

3. **REMOVE THE MIDDLE CART SHELF (ACCESSORY)** by pulling down on the locking knob underneath the Shelf (Figure 4.6); hold the locking knob in the down position, and slide the Shelf off of the unit.

4. **REPLACING CART SHELVES.** Align the track grooves in the Cart Shelf with the tracks on the Cart and slide the Shelf toward the rear of the Cart until the latching pin engages the locking groove on the underside of the shelf. Check that the shelf is positively locked.

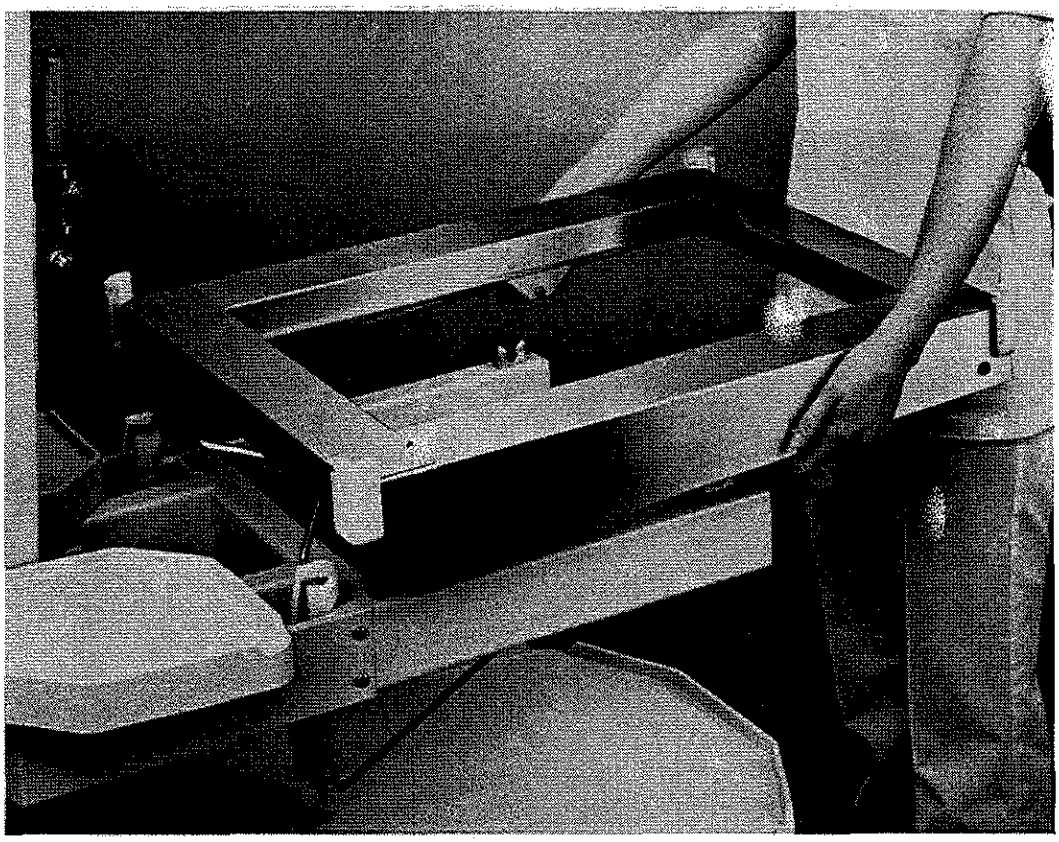


FIGURE 4.4 REMOVING BASSINET FROM CART

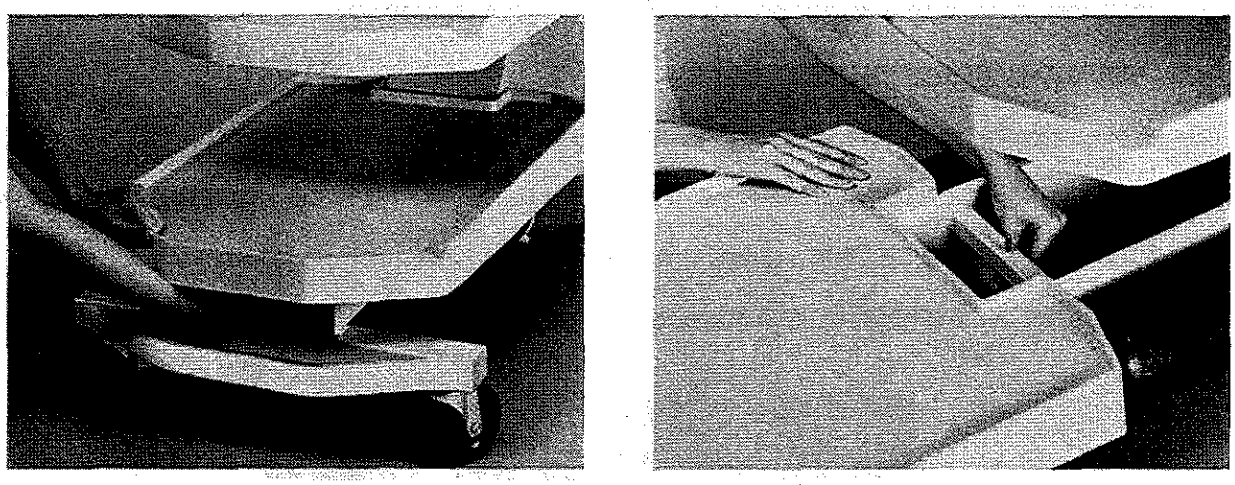


FIGURE 4.5 REMOVING BOTTOM CART SHELF

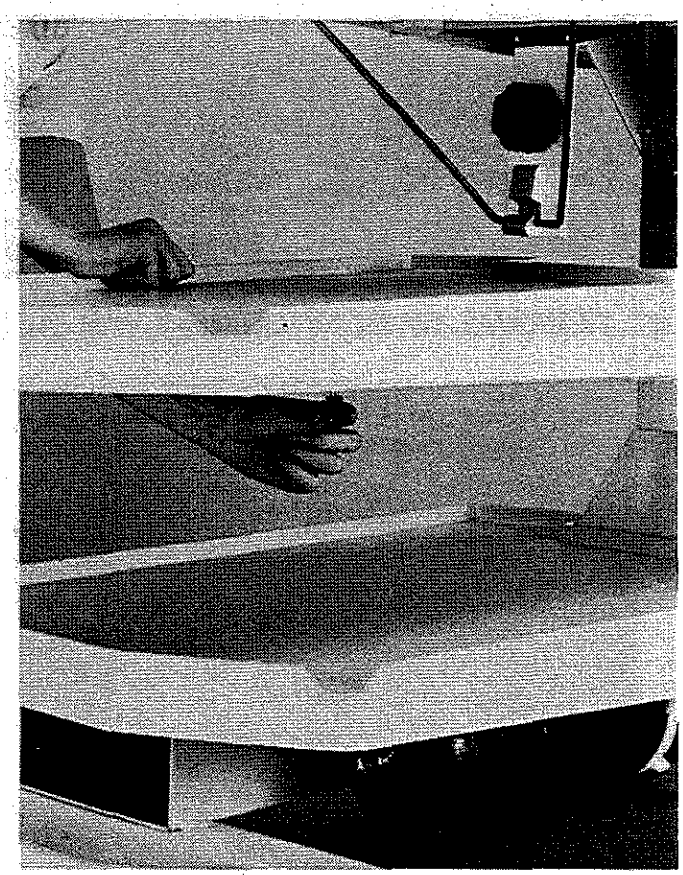


FIGURE 4.6 REMOVING MIDDLE CART SHELF (ACCESSORY)

4.3.3 REMOVAL OF MONITOR SHELVES (ACCESSORY)

1. **REMOVE ANY MONITOR SHELF** (Figure 4.7) from the Post by lifting up on the shelf to remove the swivel pin from the bearing mount on the Post.
2. **REPLACE ANY MONITOR SHELF** by reversing the above procedure.

4.3.4 REMOVAL OF INSTRUMENT TRAYS

To remove either of the Instrument Trays, refer to Figure 4.8 and proceed as follows:

1. **LOOSEN THE RETAINING KNOB** that secures the instrument Tray to the Instrument Tray Support.
2. **PULL OUT ON THE TRAY** to release it from the Post and lift the Tray up to remove.
3. **REPLACE THE INSTRUMENT TRAY** by reversing the above procedure.

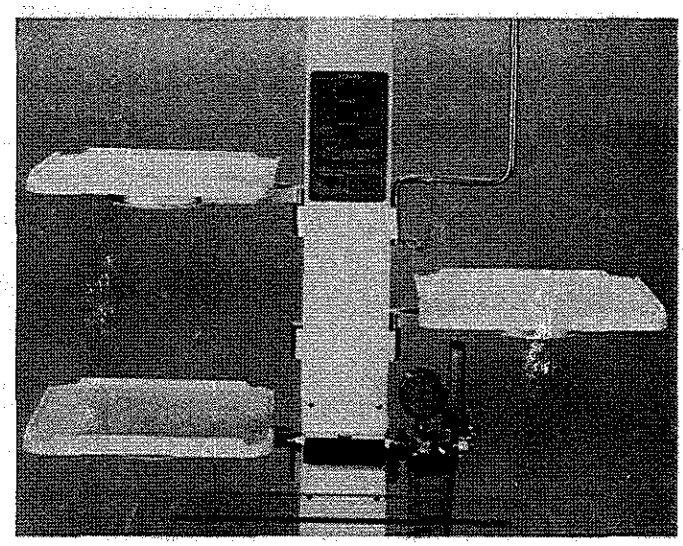


FIGURE 4.7 REMOVAL OF MONITOR SHELVES (ACCESSORY)

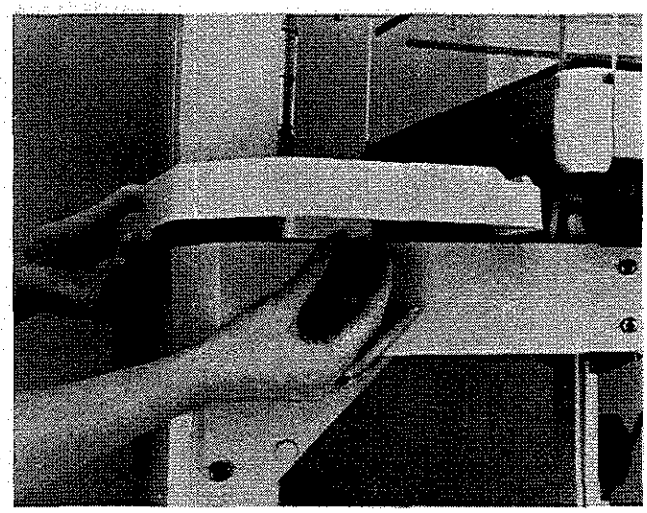


FIGURE 4.8 REMOVAL OF INSTRUMENT TRAY

4.4 CLEANING PROCEDURES

When an infant is discharged, or at least once a week, the equipment should be thoroughly cleaned and disinfected.

4.4.1 CLEANING AGENTS

An iodophor or quaternary disinfectant–detergent registered by the U.S. Environmental Protection Agency should be used, but only after the equipment is disassembled as described elsewhere in this section. A cleanser such as Air–Shields Kleenaseptic® Germicidal Surface Cleanser may be used. When using any cleaning agent, follow the manufacturer's directions for use. Before cleaning, remove all solid wastes and contaminants from the disassembled parts.

4.4.2 PAINTED SURFACES

Use a disinfectant–detergent to clean all surfaces thoroughly, then dry with a clean cloth or paper towel.

4.4.3 CLEAR PLASTIC AND ACRYLIC SURFACES

CAUTION:

- **Alcohol can cause crazing of plastic and acrylic. Do not use alcohol, acetone, or any organic solvents for cleaning.**
- **Do not expose plastic and acrylic to direct radiation from germicidal lamps. Ultraviolet radiation from these sources can cause cracking and crazing of clear plastic and acrylic.**

Use a disinfectant–detergent to clean all surfaces thoroughly. Make sure to clean all holes, indentations, baffles, etc., then dry with a clean cloth or paper towel.

4.4.4 METAL SURFACES

Use a disinfectant–detergent to thoroughly clean all surfaces, then dry with a clean cloth or paper towel.

IMPORTANT: After cleaning, a complete operational checkout (paragraph 2.6) should be performed before returning the unit to service.

4.4.5 SKIN PROBE (REUSABLE PROBES ONLY)

CAUTION: Do not pull on the tip of the skin probe when cleaning or drying; damage to the skin probe may result.

Use a disinfectant–detergent to thoroughly clean all surfaces, then dry with a clean cloth or paper towel.

4.4.6 QUARTZ HEATING ELEMENT

Clean thoroughly with alcohol.

4.5 STERILIZATION

CAUTION: DO NOT STEAM AUTOCLAVE. Gas sterilization temperature should not exceed 54.4 °C (130 °F).

Sterilization can be accomplished with the following agents:

1. **COLD STERILIZATION**

2. **GAS STERILIZATION (ETHYLENE OXIDE).** Prior to gas sterilization, the equipment should be thoroughly cleaned as described elsewhere in this section. Remove and discard all used disposable elements. New disposable elements should be installed after sterilization.

   Standard gas sterilization procedures as programmed by automatic equipment such as made by American Sterilizers and Wilmot Castle are satisfactory as these do not normally exceed 54.4 °C (130 °F).

   IMPORTANT: After sterilization, a complete operational checkout should be performed before returning the unit to service.

4.6 CALIBRATION SCHEDULE

It is recommended that the Controller and Power Module be tested and calibrated at least every four to six months and after repairs have been made. Calibration and test procedures are provided in Section 5 of this manual.

SECTION 5
SERVICE

5.1 GENERAL

This section provides calibration, troubleshooting, and removal and replacement instructions for the equipment.

5.2 TEST AND CALIBRATION PROCEDURES

5.2.1 GENERAL

This paragraph provides calibration and test procedures for the equipment. Unless otherwise indicated, all test and calibration procedures are performed under the following conditions:

IMPORTANT:

- Systems with Series 00 Power Modules: The test and calibration procedures must be performed when either the Power Module or Controller is repaired or replaced. The only exception to this rule is when the two units are replaced with a set of units known to have been calibrated as a matched pair.
- Systems with Series 01 Power Modules: The Controllers and Power Modules in these systems may be interchanged without recalibration if the Controller had originally been calibrated to operate with a Series 01 Power Module; otherwise, recalibration is required.

1. **THE EQUIPMENT IS CONNECTED TO A PRIMARY POWER SOURCE** of the correct voltage and frequency. (Refer to data tags.)
2. **AMBIENT TEMPERATURE FOR TEST** and calibration is 24.0 °C ± 3.0 °C (75.0 °F ± 5.0 °F).

5.2.2 TEST EQUIPMENT REQUIRED

The following test equipment is required for test and/or calibration. Equivalent test equipment may be substituted.

- Variac – General Radio Model W5MT3A (100V and 110/120V models)
- Variac – General Radio Model W20HMT3A (220/240V models)
- Digital Voltmeter – Fluke 8000A
- Extender Board – Hill–Rom Air–Shields Part No. 78 319 70
- Oscilloscope – Tektronix 561A
- Extension Ribbon Cable – Hill–Rom Air–Shields Part No. 78 319 20
- Probe Simulator – Hill–Rom Air–Shields Part No. 68 900 80

NOTE: Probe Simulator Part No. 68 900 80 is also used for test and calibration of the Model C100 Infant Incubator.

5.2.3 POWER MODULE CALIBRATION PROCEDURE

IMPORTANT: This calibration procedure applies only to the Series 01 or higher Power Module. The Series 00 Power Module has no adjustments.

(Change 13)

TEST HOOKUP

1. **REMOVE THE POWER MODULE** from the Warmer Housing (refer to paragraph 5.4.2 and Figure 5.1).

2. **REFER TO FIGURE 7.1A** and connect jumper wires to the Power Module as follows.

   J2–9 to J2–21
   J2–7 to J2–19
   J2–11 to J2–23

This replaces the connections normally supplied by the WARMER switch.

3. **CONNECT LINE VOLTAGE TO THE POWER MODULE** using a Variac, Adjust the input voltage as follows:

   110/120V Power Module; 115 VAC ± 1.0 VAC
   220/240V Power Module; 230 VAC ± 1.0 VAC
   100V Power Module; 100 VAC ± 1.0 VAC

PROCEDURE

1. **CONNECT A DIGITAL VOLTMETER** between TP1 and TP4 (ground) and adjust R6 for a reading of +12.6V ± 50 mV.

2. **CONNECT A DIGITAL VOLTMETER** between TP2 and TP4 (ground) and adjust R9 for a reading of +5.0V ± 50 mV.

3. **CONNECT A DIGITAL VOLTMETER** between TP3 and TP4 (ground) and adjust R12 for a reading of –12.0V ± 50 mV.

4. **REINSTALL THE POWER MODULE** in the Warmer Housing.

5.2.4 CONTROLLER CALIBRATION PROCEDURE

IMPORTANT:

- When calibrating the Controller, all adjustment procedures must be performed in the order given to obtain correct results.
- If any procedure cannot be completed, refer to the appropriate troubleshooting information given in paragraph 5.3.

TEST HOOKUP

1. **REMOVE THE CONTROLLER** from the Mounting Post (refer to paragraph 5.4.3).

2. **REMOVE PCB3** from the Controller and reinstall using Extender Board, Part No. 78 319 70 to provide access to test points and adjustments.

3. **USING EXTENSION RIBBON CABLE**, part no 78 319 20, reconnect the Controller to the interconnecting ribbon cable (item 2, Figure 5.2).

4. **CONNECT THE PROBE SIMULATOR** part no. 68 900 80 to the PATIENT PROBE jack on the Controller.

5. **CONNECT LINE VOLTAGE** to the Power Module using a Variac. Adjust the line voltage as follows:

   110/120V Power Module; 115 VAC ± 1.0 VAC
   220/240V Power Module; 230 VAC ± 1.0 VAC
   100V Power Module; 100 VAC ± 1.0 VAC

6. **SET THE WARMER SWITCH** on the Warmer Housing to the ON–1 position.

ANALOG CALIBRATION

1. **CONTROL VOLTAGE ADJUSTMENT**

   A. Set the CONTROL MODE switch on the Controller to SKIN position, the SKIN indicator should light.

   B. Set the SKIN TEMP. °C thumbwheel switches on the Controller to 36.0 °C.

   C. Set the control switch on the Probe Simulator to SKIN and the °C switch to 36.0 °C.

   D. Connect a digital voltmeter to J3–12 on PCB3 (Figure 5.2); the ground connection is J3–3,4.

   E. Adjust potentiometer R2 on PCB2 (Figure 5.2) until the digital voltmeter reads 0.0 ± 0.05 VDC.

DISPLAY CALIBRATION

1. **OFFSET ADJUSTMENT**

   A. Set the CONTROL MODE switch on the Controller to MANUAL position, the MANUAL indicator should flash continuously.

   B. Set the °C switch on the Probe Simulator to 25.0 °C.

   C. Adjust potentiometer R2 on PCB1 (Figure 5.2) until the digital display indicates 25.0 °C.

2. **GAIN ADJUSTMENT**

   A. Set the °C switch on the Probe Simulator to 36.0 °C.

   B. Adjust potentiometer R7 on PCB1 (Figure 5.2) until the digital display indicates 36.0 °C.

NOTE: It may be necessary to repeat the Offset and Gain Adjustments to obtain accurate results.

CONTROL CIRCUIT CALIBRATION

1. LINE VOLTAGE ADJUSTMENT

A. Set the CONTROL MODE switch on the Controller to SKIN position, the SKIN indicator should light.

B. Set the SKIN TEMP. °C thumbwheel switches on the Controller to 36.4 °C.

C. Set the °C switch on the Probe Simulator to 36.0 °C.

D. Connect a digital voltmeter to J3–14 on PCB3 (Figure 5.2); the ground connection is J3–3,4.

E. Adjust line voltage until digital voltmeter indicates 23.3 ± 0.02 VDC.

F. Connect a digital voltmeter to J3–25 on PCB3 (Figure 5.2); the ground connection is J3–3,4.

G. Adjust potentiometer R6 on PCB3 until the digital voltmeter indicates +1.80 ± 0.05 VDC with full heater power.

H. Readjust the line voltage as follows:

110/120V Models; 115 ± 1.0 VAC

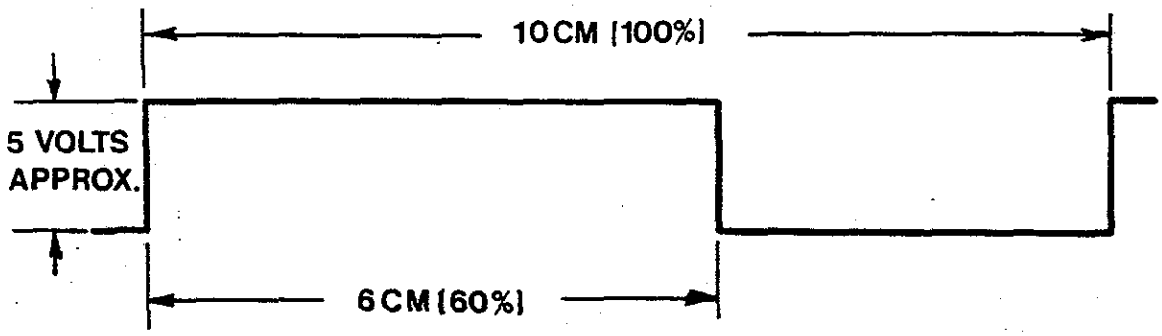
220/240V Models; 230 ± 1.0 VAC

100V Models; 100 ± 1.0 VAC

2. DUTY CYCLE ADJUSTMENT

A. Set the SKIN TEMP °C thumbwheel switches on the Controller to 36.0 °C.

B. Connect an oscilloscope to J3–11 on PCB3 and adjust potentiometer R14 on PCB3 (Figure 5.2) for a duty cycle of 60% as shown below.

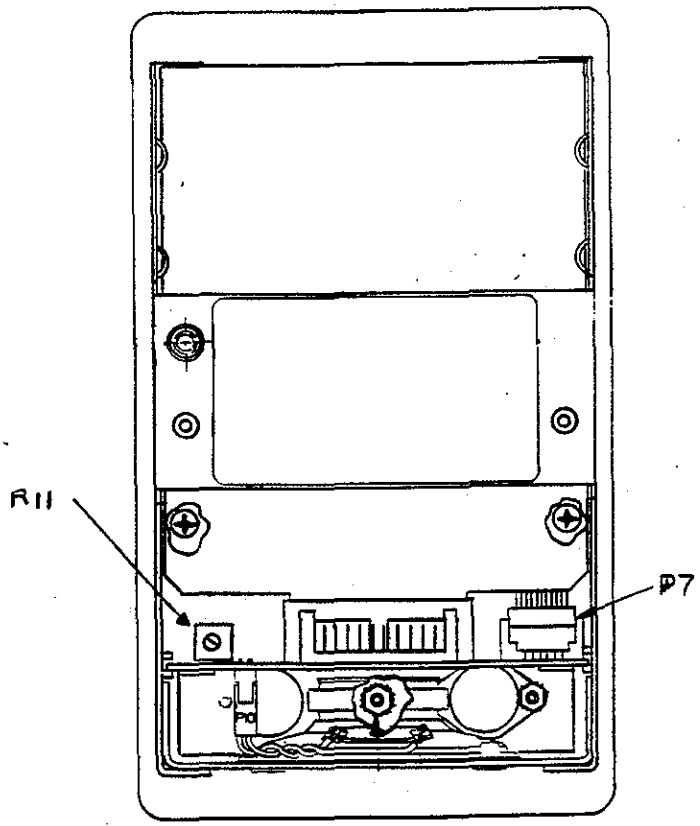


5.2.5 ALARM SOUND LEVEL ADJUSTMENT

The Alarm Sound Level is factory set for a level of 65 dBA minimum. To lower the sound level, proceed as follows:

Equipment required: Sound Level Meter 45–75 dBA Range.

1. Locate the Sound Level Meter 3 meters (11 ft, 9 in) from the front of the Controller and 1.8 meters (7 ft, 1 in) from floor level.
2. Adjust R11 on PCB for the desired sound level.



5. 0 PCB4 MOTHERBOARD ASSEMBLY

5.2.6 PERFORMANCE CHECKS – SKIN CONTROL MODE

TEST CONDITIONS

1. **SET THE WARMER SWITCH** on the Warmer Housing to the OFF–0 position.
2. **REMOVE THE EXTENDER BOARD** from the Controller and disconnect the extension ribbon cable.
3. **REINSTALL PCB3** in the Controller, reconnect the Controller to the Power Module, and reinstall the Controller in the Mounting Post (Figure 5.2).
4. **SET THE CONTROL MODE SWITCH** on the Controller to SKIN position.
5. **SET THE SKIN TEMP °C THUMBWHEEL SWITCHES** on the Controller to 36.0 °C.

6. **CONNECT THE PROBE SIMULATOR**, Part No. 68 900 80 to the PATIENT PROBE jack on the Controller; set the control switch to SKIN and the °C switch to 36.0 °C.

START–UP SEQUENCE

1. **SET THE WARMER SWITCH ON THE WARMER HOUSING** to the ON–1 position.

NOTE: During the automatic test sequence, disregard other extraneous displays or indications which may occur within this sequence.

A. The SKIN TEMP °C digital display should display all eights (88.8).

B. All HEATER power indicators should light.

C. After a short delay, the displays blank, the PROBE FAIL and SET POINT alarm indicators light and the audible alarm sounds and then stops.

D. After a short delay, the PROBE FAIL and SET POINT indicators light again, the audible alarm sounds, and the HEATER power indicators go out. When the PROBE FAIL and SET POINT alarms stop the automatic test sequence is complete.

SKIN TEMPERATURE DISPLAY

1. **SET THE PROBE SIMULATOR** to 25.0 °C, 36.0 °C and 40.0 °C; the SKIN TEMP °C display should be accurate to within ± 0.1 °C for all settings.

2. **DEPRESS THE CAL CHECK SWITCH**; the SKIN TEMP display should indicate 36.0 ± 0.1 °C to indicate that the unit is calibrated.

HEATER LEVEL

1. **SET THE °C SWITCH** ON THE Probe Simulator to 36.0 °C.

2. **SET THE SKIN TEMP °C THUMBWHEEL SWITCHES** on the Controller to 36.0 °C; two or three HEATER level indicators should be illuminated.

3. **PROBE FAILURE ALARM (SHORTED)**

A. SET THE SKIN TEMP °C THUMBWHEEL SWITCHES on the Controller to 36.0 °C and the °C switch on the Probe Simulator to 36.0 °C; the digital display should indicate 36.0 °C.

B. SET THE °C SWITCH on the Probe Simulator to SHORT. The digital display should blank continuously or intermittently.

C. AFTER A 14 to 20 SECOND DELAY, a continuous alarm should sound, the PROBE FAIL and SET POINT indicators should flash, and HEATER indicators should be off. This alarm condition cannot be reset until the alarm condition is corrected.

D. TO RESET THE CIRCUIT, set the °C switch on the Probe Simulator to 36.0 °C and depress the SILENCE/RESET switch; the unit should return to normal operating condition.

4. **PROBE FAILURE ALARM (OPEN)**

   A. SET THE SKIN TEMP °C THUMBWHEEL SWITCHES on the Controller to 36.0 °C and the °C switch on the Probe Simulator to 36.0 °C; the digital display should indicate 36.0 °C.

   B. SET THE °C SWITCH on the Probe Simulator to OPEN. The digital display should blank continuously or intermittently.

   C. AFTER A 14 TO 20 SECOND DELAY, a continuous alarm should sound, the PROBE FAIL and SET POINT indicators should flash, and HEATER indicators should be off. This alarm condition cannot be reset until the alarm condition is corrected.

   D. TO RESET THE CIRCUIT, set the °C switch on the Probe Simulator to 36.0 °C and depress the SILENCE/RESET switch; the unit should return to normal operating condition.

PROBE FAILURE ALARM (HIGH SKIN TEMPERATURE (39.0°C))

1. **SET THE SKIN TEMP °C THUMBWHEEL SWITCHES** on the Controller to 36.0 °C and the °C switch on the Probe Simulator to 40.0 °C.

2. **AFTER A 14 TO 20 SECOND DELAY,** a continuous alarm should sound, the SET POINT AND PROBE FAIL indicators should flash, and all HEATER indicators should be off. This alarm condition cannot be reset until the alarm condition is corrected.

3. **TO RESET THE CIRCUIT,** set the °C switch on the Probe Simulator to 36.0 °C and depress the SILENCE/RESET switch; the unit should return to normal operating condition.

HIGH SKIN TEMPERATURE MODEL CM78–1

1. **SET THE SKIN TEMP ° C THUMBWHEEL SWITCHES** on the Controller to 36.0 °C, the control switch on the probe simulator to SKIN, and the °C switch on the probe simulator to 36.0 °C; the digital display should indicate 36.0 °C and the alarms should not be activated. Typically, two heater indicators should be lit.

2. **SET THE SKIN TEMP °C THUMBWHEEL SWITCHES** on the Controller to 35.3 °C. All heater indicators should be off.

3. **AFTER A 14 TO 20 SECOND DELAY**, a continuous alarm should sound, and the SET POINT indicator should flash. This alarm condition cannot be reset until the alarm condition is corrected.

4. **TO RESET THE CIRCUIT**, set the SKIN TEMP °C thumbwheel switches on the Controller to 36.0 °C; and depress the SILENCE/RESET Switch; the unit should return to normal operating condition.

HIGH SKIN TEMPERATURE MODEL CM78–2

1. **SET THE SKIN TEMP °C THUMBWHEEL SWITCHES** on the Controller to 36.0 °C, the control switch on the probe simulator to SKIN, and the °C switch on the probe simulator to 36.0 °C; the digital display should indicate 36.0 °C and the alarms should not be activated. Typically, two heater indicators should be lit.

2. **SET THE SKIN TEMP °C THUMBWHEEL SWITCHES** on the Controller to 35.3 °C for Series 00–02 to 34.7 °C for Series 03 or higher. All heater indicators should be off.

(Change 10)

3. **AFTER A 14 TO 20 SECOND DELAY,** a continuous alarm should sound and the SET POINT indicator should flash.

4. **TO RESET THE CIRCUIT,** set the SKIN TEMP °C thumbwheel switches on the Controller to 36.0 °C; the unit should return to normal operating condition.

LOW SKIN TEMPERATURE

1. **SET THE SKIN TEMP °C THUMBWHEEL SWITCHES** on the Controller to 36.0 °C, the control switch on the probe simulator to SKIN, and the °C switch on the probe simulator to 36.0 °C; the digital display should indicate 36.0 °C and the alarms should not be activated. Typically, two heater indicators should be lit.
2. **SET THE SKIN TEMP °C THUMBWHEEL SWITCHES** on the Controller to 36.7 °C for CM78–1 or for CM78–2 Series 00–02 or to 37.3 °C for CM78–2 Series 03 and higher. All heater indicators should be lit.
3. **AFTER A 14 TO 20 SECOND DELAY,** a continuous alarm should sound and the SET POINT indicator should flash.
4. **DEPRESS THE SILENCE/RESET SWITCH,** the alarm should be silenced but the SET POINT indicator should continue to flash. All heater indicators should be lit.
5. **SET THE SKIN TEMP °C THUMBWHEEL SWITCHES** on the Controller to 36.0 °C. The circuit should reset automatically and the SET POINT indicator should turn off. Typically, two heater indicators should be lit.

5.2.7 PERFORMANCE CHECKS – MANUAL CONTROL MODE

STANDARD ALARMS DISABLED CHECK

1. **SET THE CONTROL MODE SWITCH** on the Controller to MANUAL; the MANUAL indicator should flash on and off continuously.
2. **CONNECT THE PROBE SIMULATOR** to the PATIENT PROBE connector on the Controller; set the control switch to SKIN and the °C switch to OPEN. The digital display should show random numbers and blank intermittently or continuously.
3. **WAIT AT LEAST 20 SECONDS,** no visual or audible alarms should occur.

NOTE: The standard alarms (except for POWER FAIL) are disabled when operating in manual mode.

15–MINUTE TIMER CHECK

1. **SET THE CONTROL MODE SWITCH TO SKIN.**
2. **SET THE CONTROL MODE SWITCH TO MANUAL,** the MANUAL indicator should flash on and off continuously indicating that the timer is running; begin measuring elapsed time.

IMPORTANT: If the MANUAL indicator does not flash on and off continuously, the 15–minute timer is inoperative.

3. **AFTER 9 TO 13 MINUTES TOTAL ELAPSED TIME,** a one-second duration beep (Manual Alert) should sound every 30 seconds; this indicates that the heater may be reset for an additional 14–20 minutes without the heater turning off. To check the reset circuitry, proceed as follows:

(Change 11)

A. Depress and hold the SILENCE/RESET switch for at least 2 seconds after the audible signal starts; this will allow time for internal circuitry to reset.

B. After 9 to 13 minutes total elapsed time, a one-second chrip sound (Manual Alert) every 30 seconds.

4. **AFTER 13 TO 20 MINUTES ELAPSED TIME**, a steady alarm should sound, the MANUAL indicator should go off and all HEATER indicators should turn off indicating that the manual heating period has ended.

5. **DEPRESS THE SILENCE/RESET SWITCH** for at least 2 seconds; this resets the circuitry and the complete cycle should repeat.

POWER FAILURE ALARM CHECK

1. **DISCONNECT THE POWER CORD** from the wall receptacle or Power Module; the POWER FAIL indicator should light and the alarm should sound continuously.

2. **RECONNECT THE POWER CORD** or set the WARMER ON-OFF switch to the OFF position to terminate the alarm.

5.3 TROUBLESHOOTING

5.3.1 GENERAL

Troubleshooting guides for the equipment are provided in paragraph 5.3.3 in the form of flowcharts. It is assumed that an attempt has been made to calibrate the equipment and that all cables are in good condition.

5.3.2 TEST EQUIPMENT REQUIRED

The test equipment listed below is required for troubleshooting the equipment. Equivalent test equipment may be substituted.

- Variac – General Radio Model W5MT3A (100V and 110/120V models)
- Variac – General Radio Model W20HMT3A (220/240V models)
- Digital Voltmeter – Fluke 8000A
- Extender Board – Hill-Rom Air-Shields Part No. 78 319 70
- Oscilloscope – Tektronix 561A
- Extension Ribbon Cable – Hill-Rom Air-Shields Part No. 78 319 20
- 2K, 10W resistor (100V and 110/120V models)
- 4K, 10W resistor (220/240V models)
- Probe Simulator – Hill-Rom Air-Shields Part No. 68 900 80

NOTE: Probe Simulator Part No. 68 900 80 is also used for test and calibration of the Model C100 Infant Incubator.

5.3.3 TROUBLESHOOTING PROCEDURES

The following flowcharts are provided as an aid in localizing the cause of equipment malfunctions. The charts are intended for use in conjunction with the equipment theory of operation (Section 3) and the schematic diagrams (Section 7). It is assumed that the Operational Checkout Procedure (paragraph 2.5) has been performed, and that the Test and Calibration Procedures (paragraph 5.2.6) have been attempted.

(Change 13)

When using the flowcharts, do not skip steps. The flowcharts have been designed to minimize the number of checks required to localize the problem area and isolate the defective component.

If the problem area is known, proceed directly to the appropriate flowchart; however, if the problem area cannot be immediately defined, first perform the Power Module output voltage test that follows.

POWER MODULE VOLTAGE TEST

TEST HOOKUP

1. **REMOVE THE CONTROLLER** from the Mounting Post (refer to paragraph 5.4.3).
2. **REMOVE PCB3** from the Controller and reinstall using Extender Board, Part No. 78 319 70, to provide access to test points and adjustments.
3. **USING EXTENSION RIBBON CABLE**, part no. 78 319 20, reconnect the Controller to the Power Module.
4. **CONNECT THE PROBE SIMULATOR,** part no. 68 900 80, to the PATIENT PROBE jack on the Controller and set the °C switch to 36.0 °C.
5. **SET THE °C THUMBWHEEL SWITCHES** on the Controller to 36.0 °C.
6. **CONNECT LINE VOLTAGE** to the Power Module using a Variac. Adjust the line voltage as follows:

   110/120V Power Module; 115 VAC ± 1.0 VAC
   220/240V Power Module; 230 VAC ± 1.0 VAC
   100V Power Module; 100 VAC ± 1.0 VAC
7. **SET THE WARMER SWITCH** on the Warmer Housing to the ON–1 position.

PROCEDURE

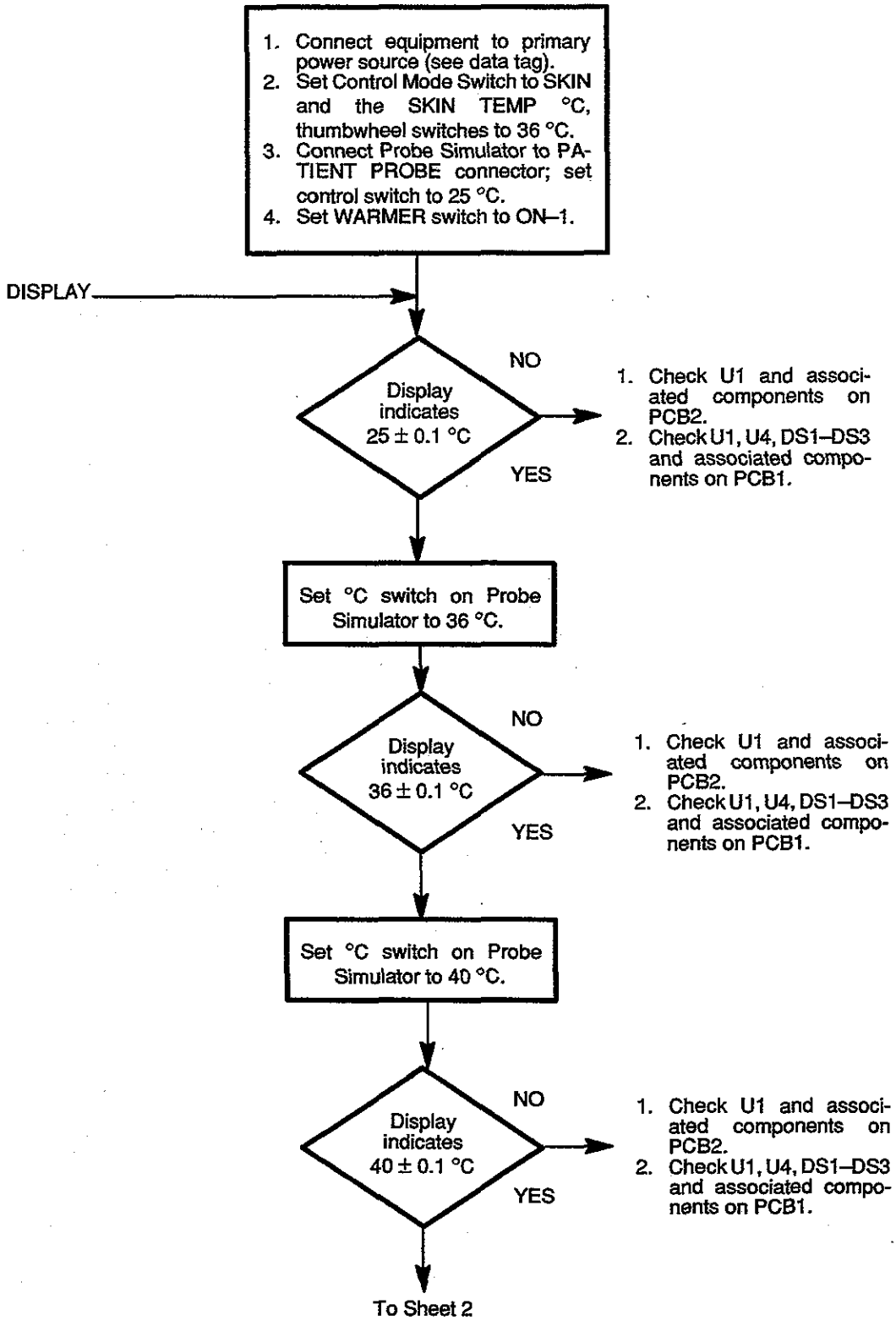
1. **USING A DIGITAL VOLTMETER**, check that the Power Module output voltages are within the limits indicated below. The test points are located on connector J3 of PCB3 in the Controller.

FROM	TO(GND)	VOLTAGE	MAXIMUM RIPPLE P–P
J3–7	J3–3	+5.0 ± 1.0 VDC	1.0V
*J3–9	J3–3	+12.6 ± 0.5 VDC	10.0 mV
*J3–9	J3–3	** +12.6 ± 50 mV	10.0 mV
J3–14	J3–3	+21.0 ± 1.0 VDC (+18.75 in 220/240V units)	1.5 V
*J3–19	J3–3	–12.0 ± 0.5 VDC	10.0 mV
*J3–19	J3–3	**–12.0 ± 50 mV	20.0 mV
*J3–23	J3–3	+5.0 ± 0.3 VDC	10.0 mV
*J3–23	J3–3	** +5.0 ± 50 mV	10.0 mV

* Reading must not vary more than 0.2V over following range of applied voltage:

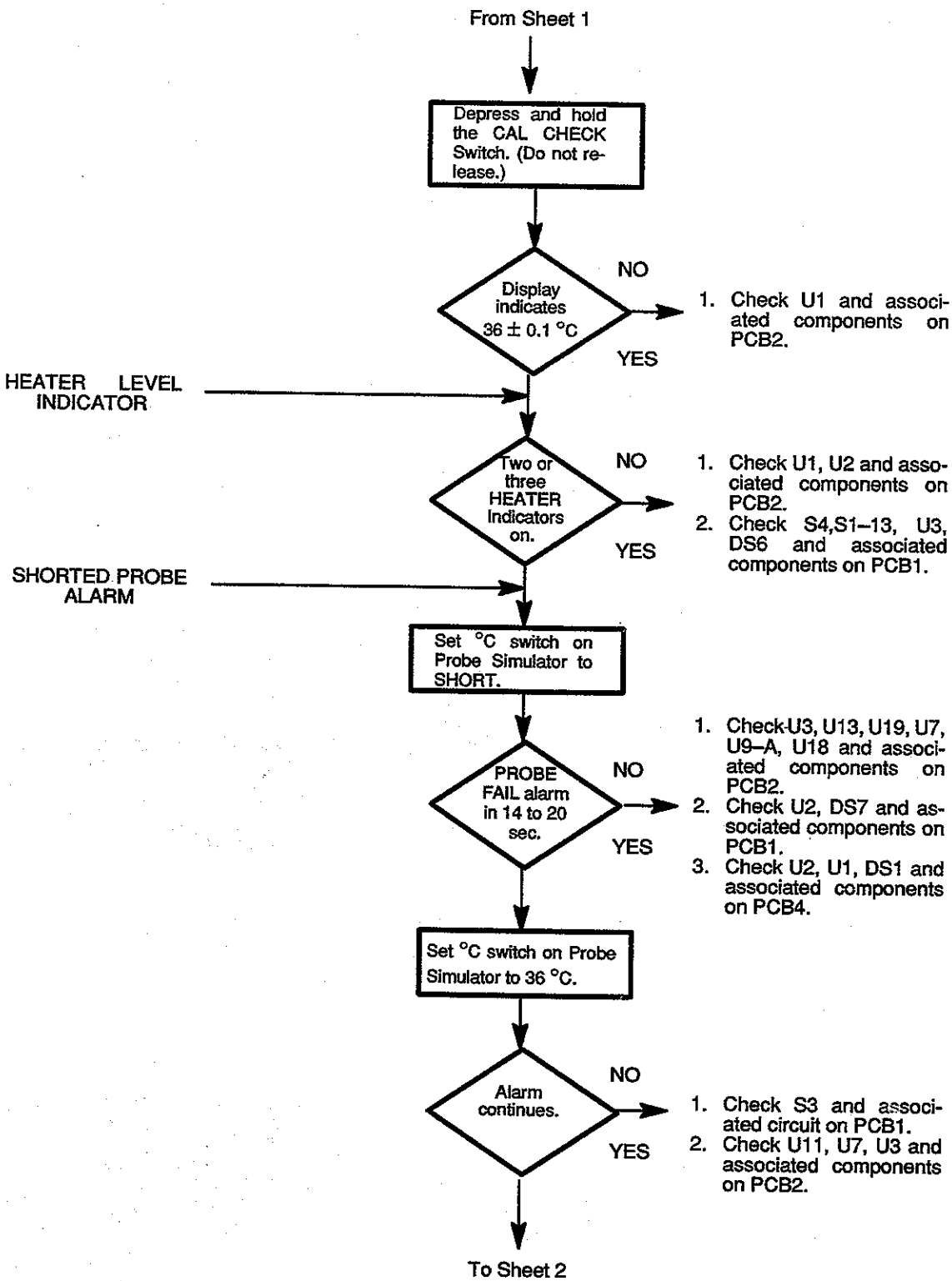
110/120V Power Module; 99 to 132 VAC
220/240V Power Module; 198 to 264 VAC
100V Power Module; 90 to 110 VAC

** Readings obtained when using a Series 01 Power Module.


1. Connect equipment to primary power source (see data tag).
2. Set Control Mode Switch to SKIN and the SKIN TEMP °C, thumbwheel switches to 36 °C.
3. Connect Probe Simulator to PATIENT PROBE connector; set control switch to 25 °C.
4. Set WARMER switch to ON–1.
DISPLAY
Display indicates 25 ± 0.1 °C
NO
YES
1. Check U1 and associated components on PCB2.
2. Check U1, U4, DS1–DS3 and associated components on PCB1.
Set °C switch on Probe Simulator to 36 °C.
Display indicates 36 ± 0.1 °C
NO
YES
1. Check U1 and associated components on PCB2.
2. Check U1, U4, DS1–DS3 and associated components on PCB1.
Set °C switch on Probe Simulator to 40 °C.
Display indicates 40 ± 0.1 °C
NO
YES
1. Check U1 and associated components on PCB2.
2. Check U1, U4, DS1–DS3 and associated components on PCB1.
To Sheet 2

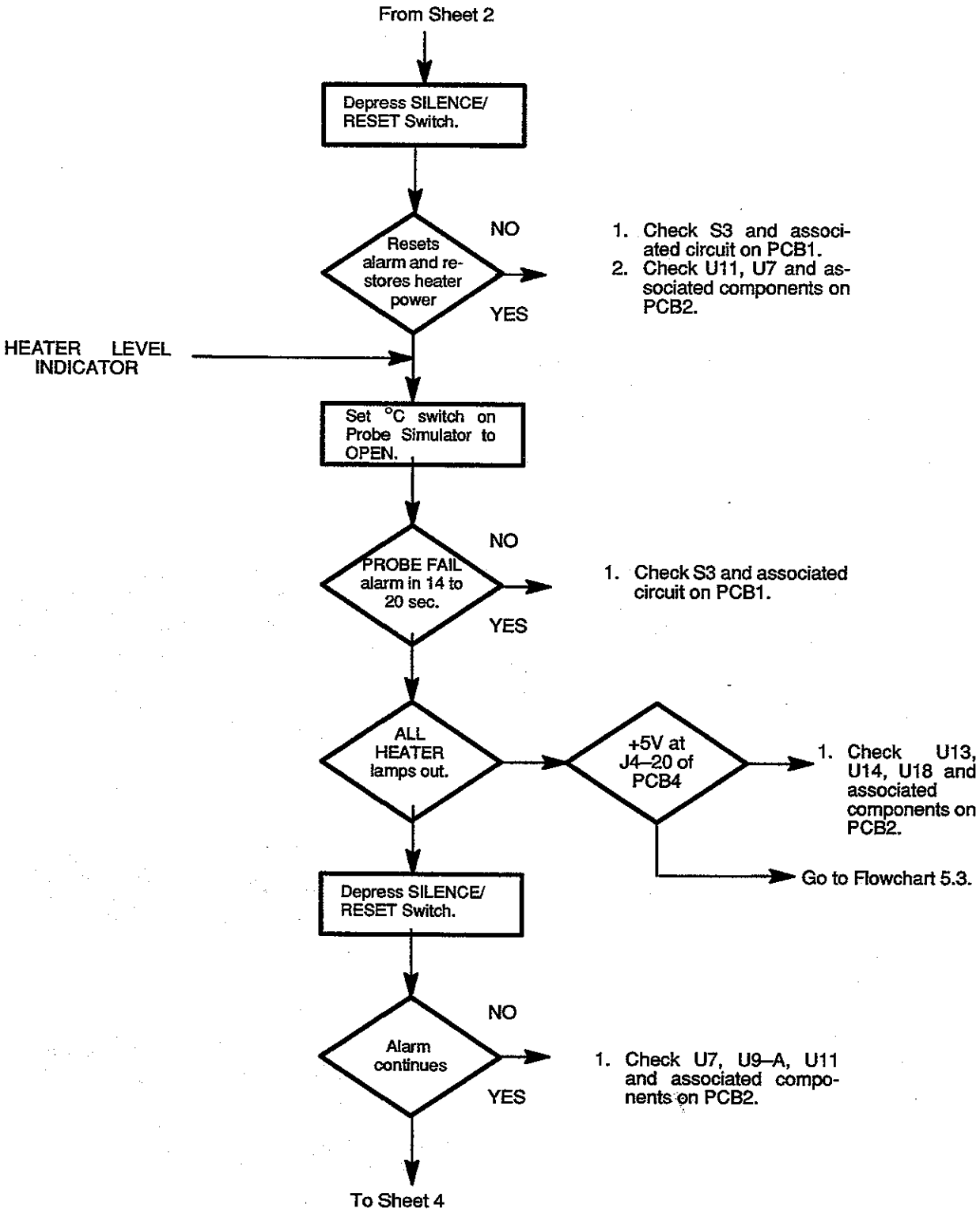
FLOWCHART 5.1 CONTROLLER MODULE TROUBLESHOOTING

(Sheet 1 of 9)


From Sheet 1
Depress and hold the CAL CHECK Switch. (Do not release.)
Display indicates 36 ± 0.1 °C
NO
YES
1. Check U1 and associated components on PCB2.
HEATER LEVEL INDICATOR
Two or three HEATER Indicators on.
NO
YES
1. Check U1, U2 and associated components on PCB2.
2. Check S4,S1–13, U3, DS6 and associated components on PCB1.
SHORTED PROBE ALARM
Set °C switch on Probe Simulator to SHORT.
PROBE FAIL alarm in 14 to 20 sec.
NO
YES
1. Check U3, U13, U19, U7, U9–A, U18 and associated components on PCB2.
2. Check U2, DS7 and associated components on PCB1.
3. Check U2, U1, DS1 and associated components on PCB4.
Set °C switch on Probe Simulator to 36 °C.
Alarm continues.
NO
YES
1. Check S3 and associated circuit on PCB1.
2. Check U11, U7, U3 and associated components on PCB2.
To Sheet 2

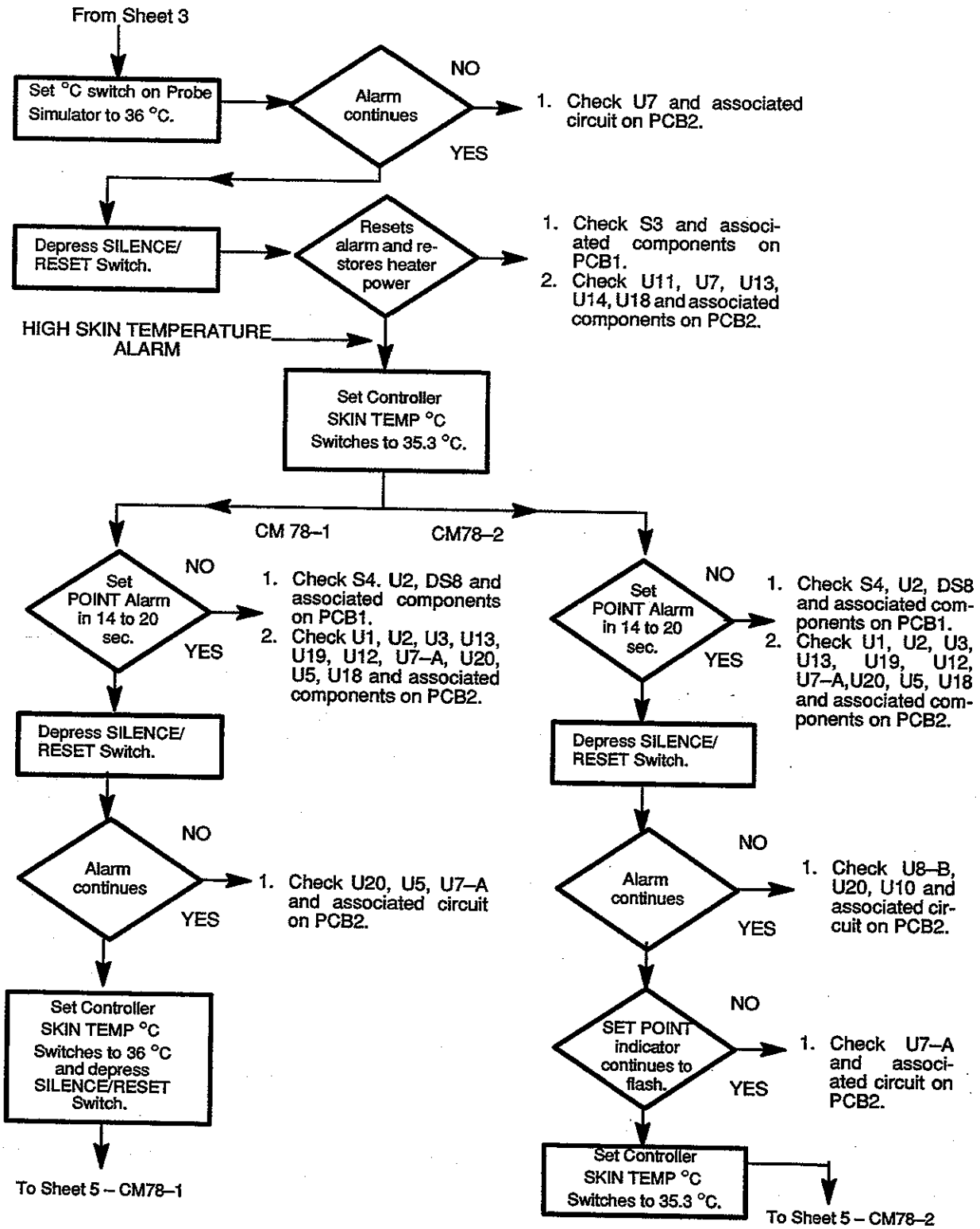
FLOWCHART 5.1 CONTROLLER MODULE TROUBLESHOOTING

(Sheet 2 of 9)


From Sheet 2
Depress SILENCE/ RESET Switch.
Resets alarm and restores heater power
NO
YES
1. Check S3 and associated circuit on PCB1.
2. Check U11, U7 and associated components on PCB2.
HEATER LEVEL INDICATOR
Set °C switch on Probe Simulator to OPEN.
PROBE FAIL alarm in 14 to 20 sec.
NO
YES
1. Check S3 and associated circuit on PCB1.
ALL HEATER lamps out.
+5V at J4–20 of PCB4
1. Check U13, U14, U18 and associated components on PCB2.
Go to Flowchart 5.3.
Depress SILENCE/ RESET Switch.
Alarm continues
NO
YES
1. Check U7, U9–A, U11 and associated components on PCB2.
To Sheet 4

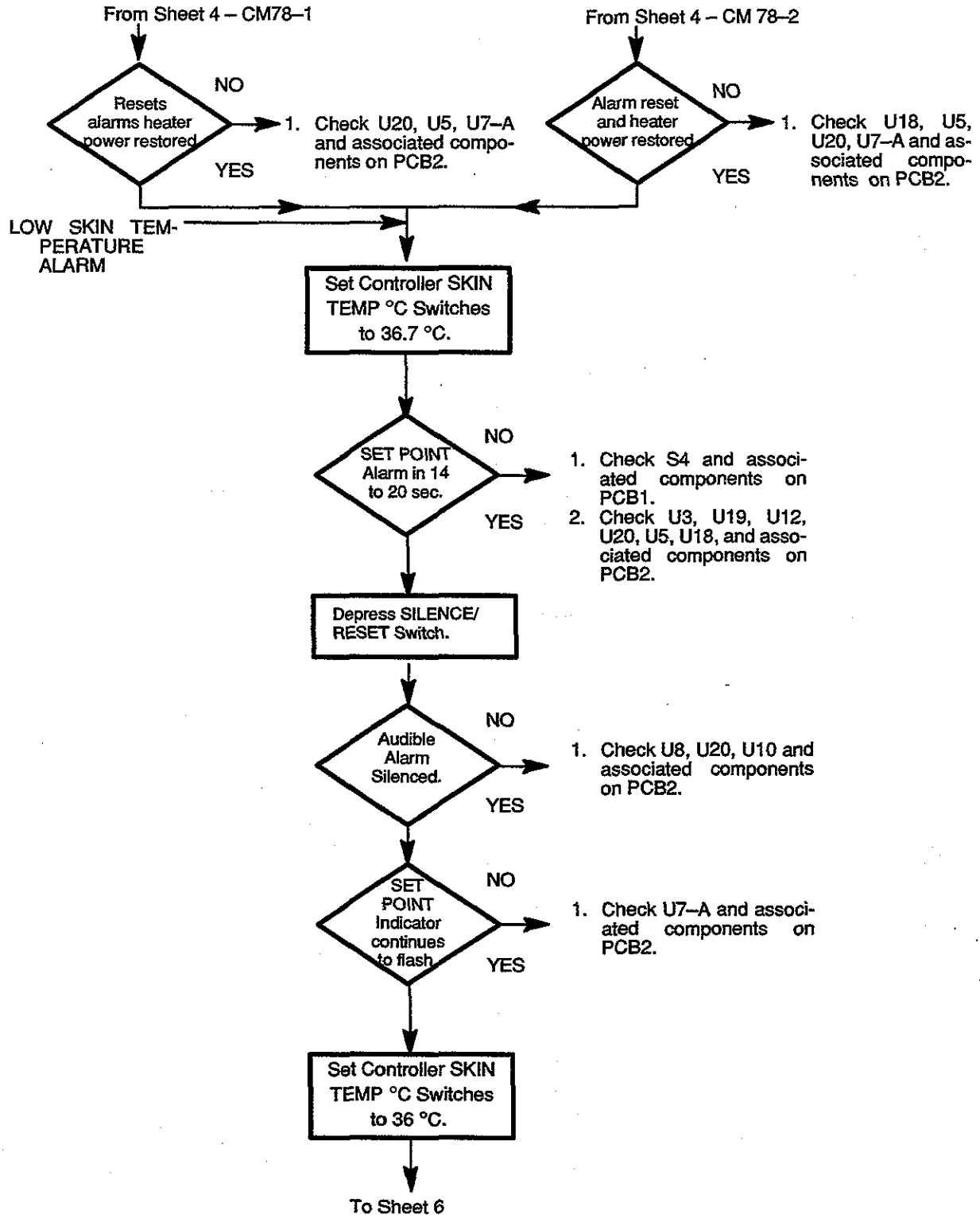
FLOWCHART 5.1 CONTROLLER MODULE TROUBLESHOOTING

(Sheet 3 of 9)


From Sheet 3
Set °C switch on Probe Simulator to 36 °C.
Alarm continues
NO
YES
1. Check U7 and associated circuit on PCB2.
Depress SILENCE/ RESET Switch.
Resets alarm and restores heater power
1. Check S3 and associated components on PCB1.
2. Check U11, U7, U13, U14, U18 and associated components on PCB2.
HIGH SKIN TEMPERATURE ALARM
Set Controller SKIN TEMP °C Switches to 35.3 °C.
CM 78–1
CM78–2
Set POINT Alarm in 14 to 20 sec.
NO
YES
1. Check S4. U2, DS8 and associated components on PCB1.
2. Check U1, U2, U3, U13, U19, U12, U7–A, U20, U5, U18 and associated components on PCB2.
Depress SILENCE/ RESET Switch.
Alarm continues
NO
YES
1. Check U20, U5, U7–A and associated circuit on PCB2.
Set Controller SKIN TEMP °C Switches to 36 °C and depress SILENCE/RESET Switch.
To Sheet 5 – CM78–1
Set POINT Alarm in 14 to 20 sec.
NO
YES
1. Check S4, U2, DS8 and associated components on PCB1.
2. Check U1, U2, U3, U13, U19, U12, U7–A,U20, U5, U18 and associated components on PCB2.
Depress SILENCE/ RESET Switch.
Alarm continues
NO
YES
1. Check U8–B, U20, U10 and associated circuit on PCB2.
SET POINT indicator continues to flash.
NO
YES
1. Check U7–A and associated circuit on PCB2.
Set Controller SKIN TEMP °C Switches to 35.3 °C.
To Sheet 5 – CM78–2

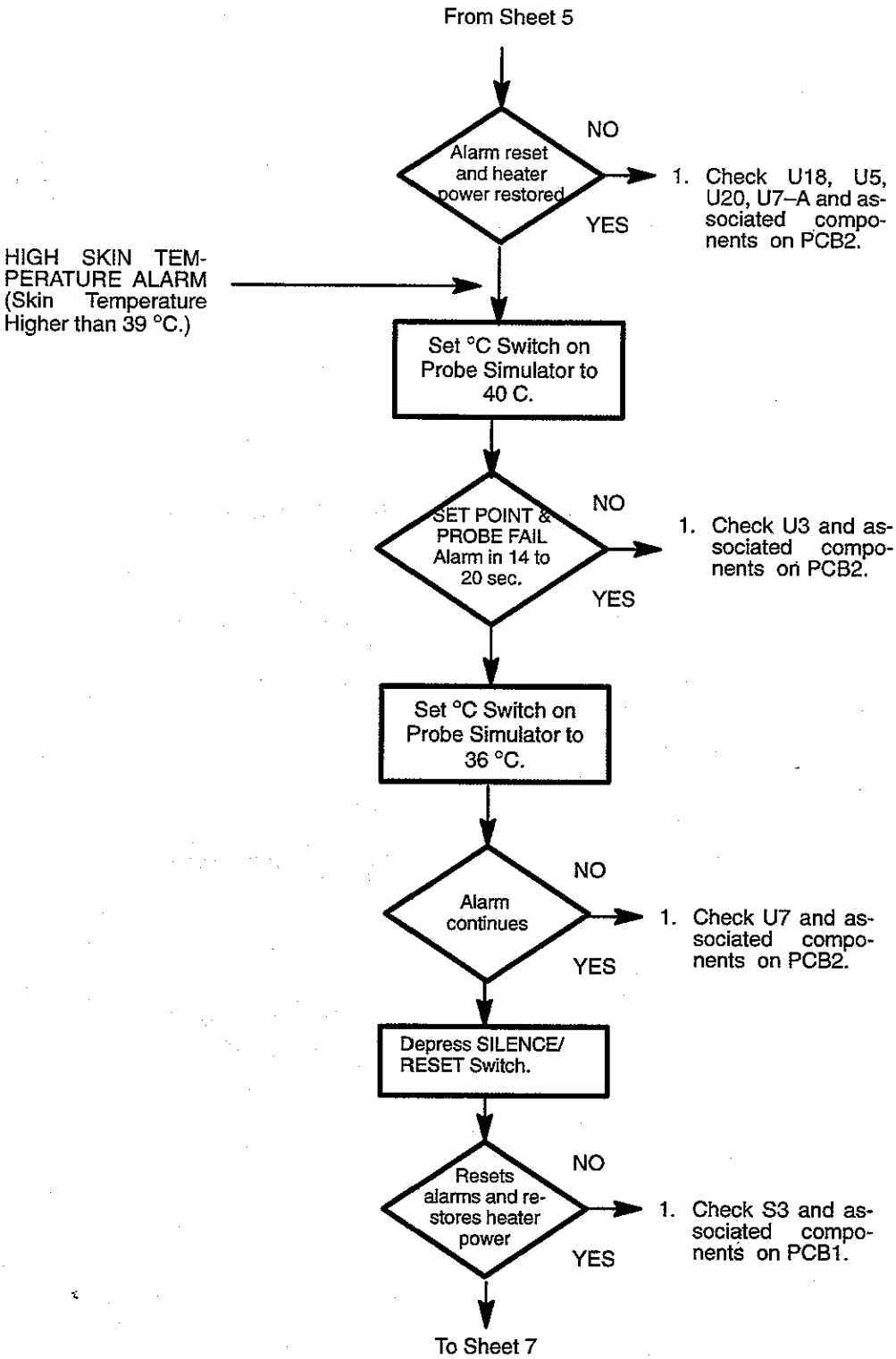
FLOWCHART 5.1 CONTROLLER MODULE TROUBLESHOOTING

(Sheet 4 of 9)


From Sheet 4 – CM78–1
Resets alarms heater power restored
NO
YES
1. Check U20, U5, U7–A and associated components on PCB2.
From Sheet 4 – CM 78–2
Alarm reset and heater power restored
NO
YES
1. Check U18, U5, U20, U7–A and associated components on PCB2.
LOW SKIN TEMPERATURE ALARM
Set Controller SKIN TEMP °C Switches to 36.7 °C.
SET POINT Alarm in 14 to 20 sec.
NO
YES
1. Check S4 and associated components on PCB1.
2. Check U3, U19, U12, U20, U5, U18, and associated components on PCB2.
Depress SILENCE/ RESET Switch.
Audible Alarm Silenced.
NO
YES
1. Check U8, U20, U10 and associated components on PCB2.
SET POINT Indicator continues to flash
NO
YES
1. Check U7–A and associated components on PCB2.
Set Controller SKIN TEMP °C Switches to 36 °C.
To Sheet 6

FLOWCHARTS 5.1 CONTROLLER MODULE TROUBLESHOOTING

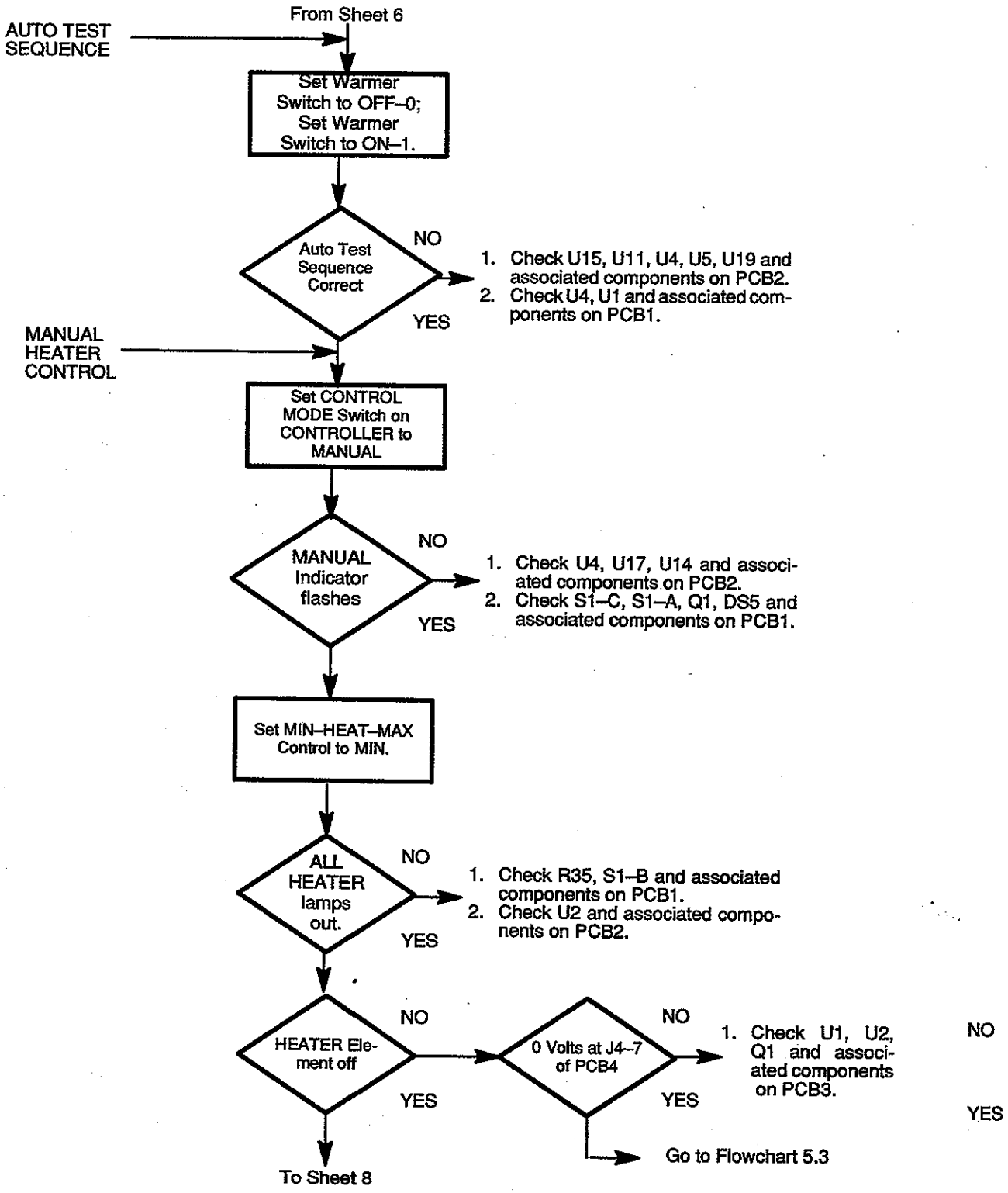
(Sheet 5 of 9)


From Sheet 5
Alarm reset and heater power restored
NO
YES
1. Check U18, U5, U20, U7–A and associated components on PCB2.
HIGH SKIN TEMPERATURE ALARM (Skin Temperature Higher than 39 °C.)
Set °C Switch on Probe Simulator to 40 C.
SET POINT & PROBE FAIL Alarm in 14 to 20 sec.
NO
YES
1. Check U3 and associated components on PCB2.
Set °C Switch on Probe Simulator to 36 °C.
Alarm continues
NO
YES
1. Check U7 and associated components on PCB2.
Depress SILENCE/ RESET Switch.
Resets alarms and restores heater power
NO
YES
1. Check S3 and associated components on PCB1.
To Sheet 7

FLOWCHART 5.1 CONTROLLER MODULE TROUBLESHOOTING

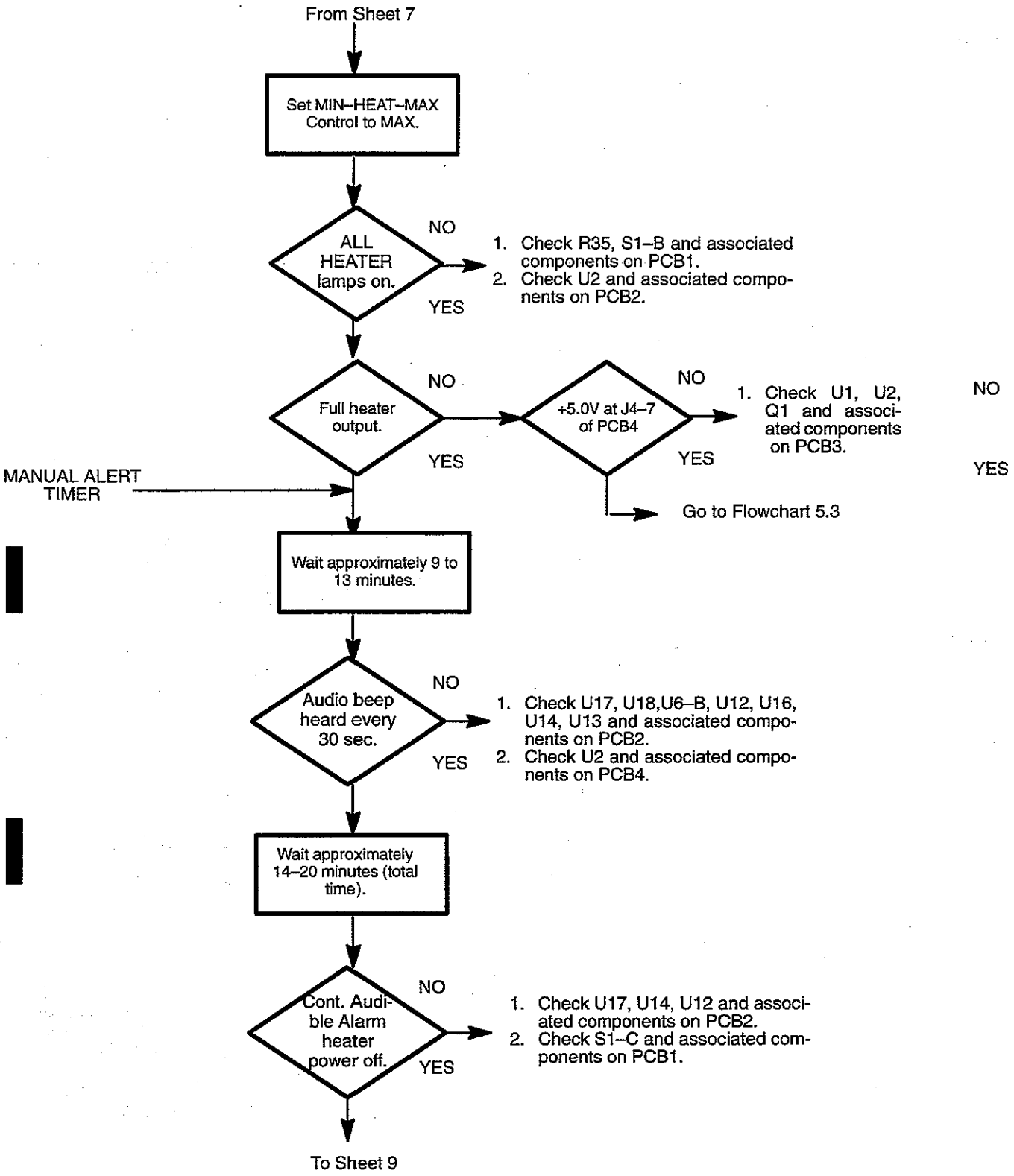
(Sheet 6 of 9)

(Change 10)


From Sheet 6
AUTO TEST SEQUENCE
Set Warmer Switch to OFF–0; Set Warmer Switch to ON–1.
Auto Test Sequence Correct
NO
YES
1. Check U15, U11, U4, U5, U19 and associated components on PCB2.
2. Check U4, U1 and associated components on PCB1.
MANUAL HEATER CONTROL
Set CONTROL MODE Switch on CONTROLLER to MANUAL
MANUAL Indicator flashes
NO
YES
1. Check U4, U17, U14 and associated components on PCB2.
2. Check S1–C, S1–A, Q1, DS5 and associated components on PCB1.
Set MIN–HEAT–MAX Control to MIN.
ALL HEATER lamps out.
NO
YES
1. Check R35, S1–B and associated components on PCB1.
2. Check U2 and associated components on PCB2.
HEATER Element off
NO
YES
0 Volts at J4–7 of PCB4
NO
YES
1. Check U1, U2, Q1 and associated components on PCB3.
NO
YES
Go to Flowchart 5.3
To Sheet 8

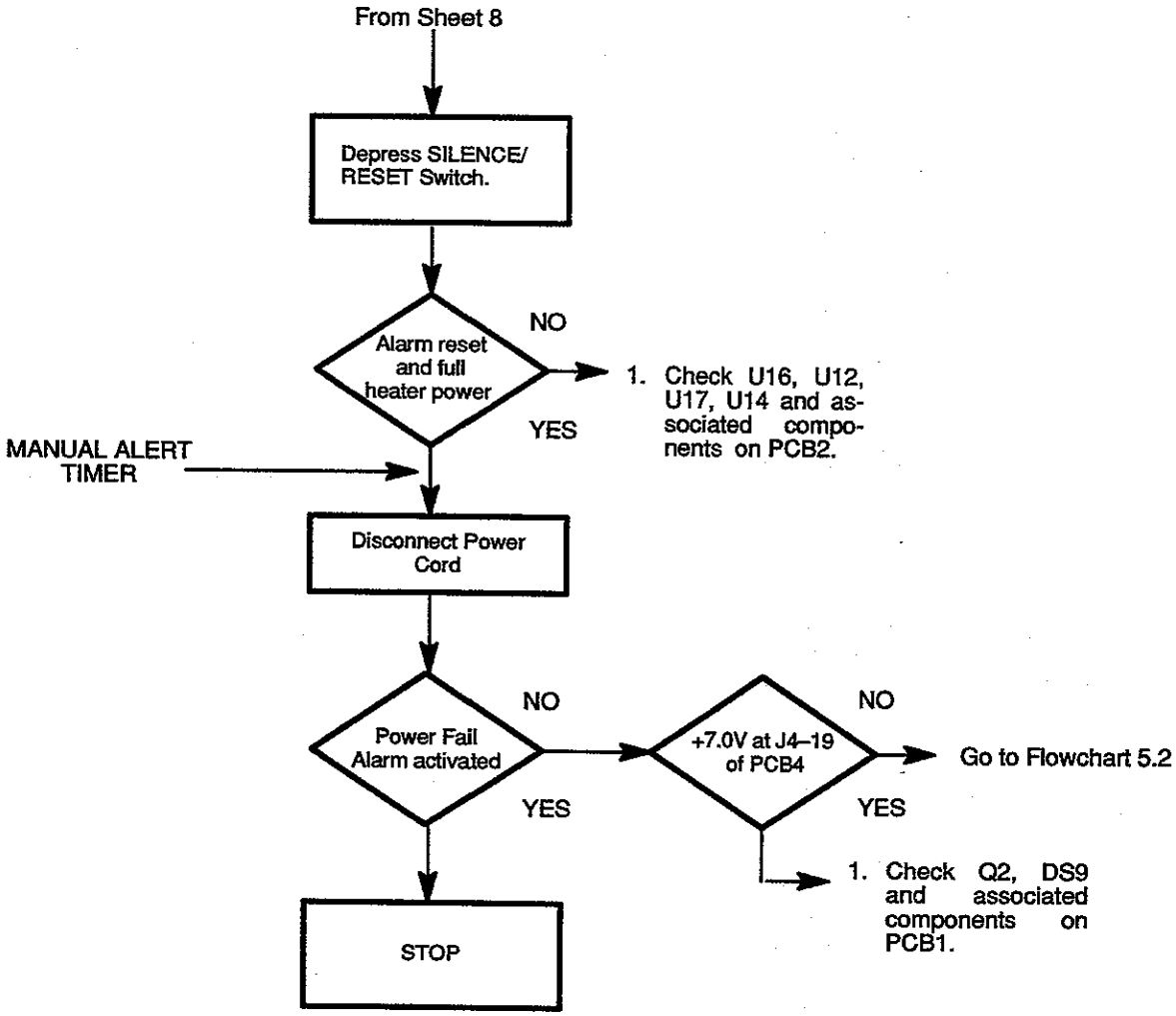
FLOWCHART 5.1 CONTROLLER MODULE TROUBLESHOOTING

(Sheet 7 of 9)


From Sheet 7
Set MIN–HEAT–MAX Control to MAX.
ALL HEATER lamps on.
NO
YES
1. Check R35, S1–B and associated components on PCB1.
2. Check U2 and associated components on PCB2.
Full heater output.
NO
YES
+5.0V at J4–7 of PCB4
NO
YES
1. Check U1, U2, Q1 and associated components on PCB3.
Go to Flowchart 5.3
MANUAL ALERT TIMER
Wait approximately 9 to 13 minutes.
Audio beep heard every 30 sec.
NO
YES
1. Check U17, U18,U6–B, U12, U16, U14, U13 and associated components on PCB2.
2. Check U2 and associated components on PCB4.
Wait approximately 14–20 minutes (total time).
Cont. Audible Alarm heater power off.
NO
YES
1. Check U17, U14, U12 and associated components on PCB2.
2. Check S1–C and associated components on PCB1.
To Sheet 9

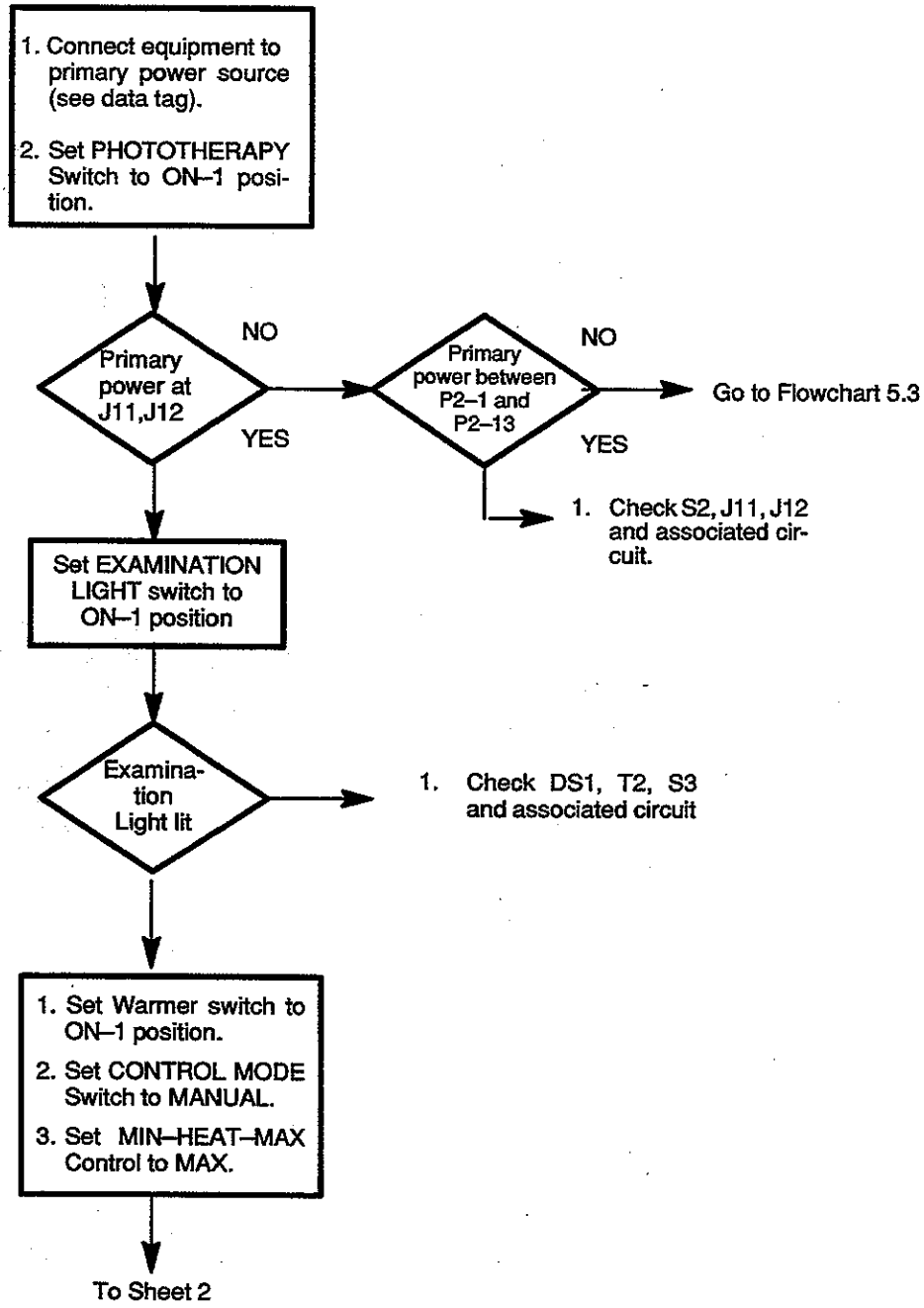
FLOWCHART 5.1 CONTROLLER MODULE TROUBLESHOOTING

(Sheet 8 of 9)
(Change 11)



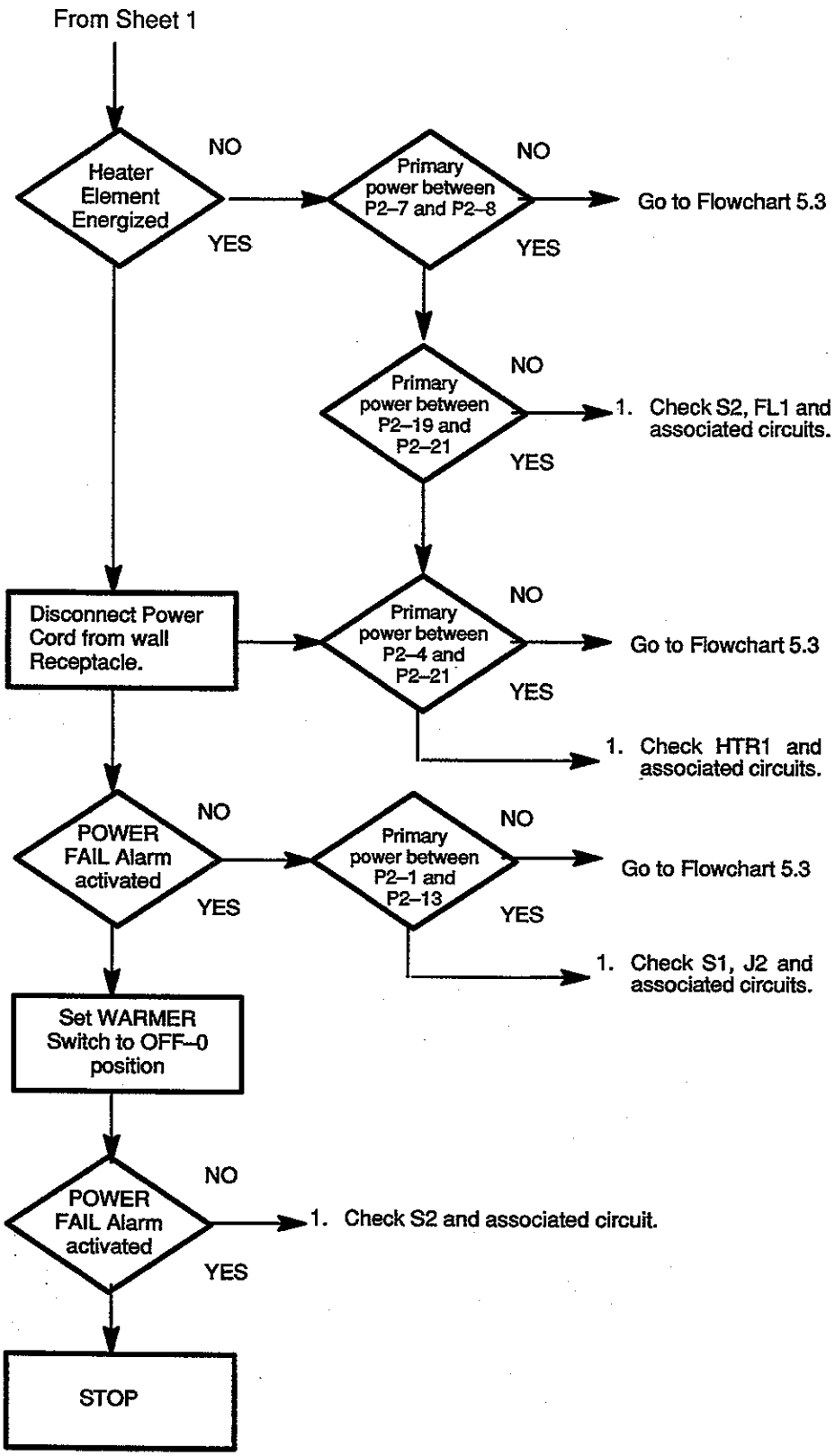
FLOWCHART 5.1 CONTROLLER MODULE TROUBLESHOOTING

(Sheet 9 of 9)


1. Connect equipment to primary power source (see data tag).
2. Set PHOTOTHERAPY Switch to ON–1 position.
Primary power at J11,J12
NO
YES
Primary power between P2–1 and P2–13
NO
YES
Go to Flowchart 5.3
1. Check S2, J11, J12 and associated circuit.
Set EXAMINATION LIGHT switch to ON–1 position
Examination Light lit
1. Check DS1, T2, S3 and associated circuit
1. Set Warmer switch to ON–1 position.
2. Set CONTROL MODE Switch to MANUAL.
3. Set MIN–HEAT–MAX Control to MAX.
To Sheet 2

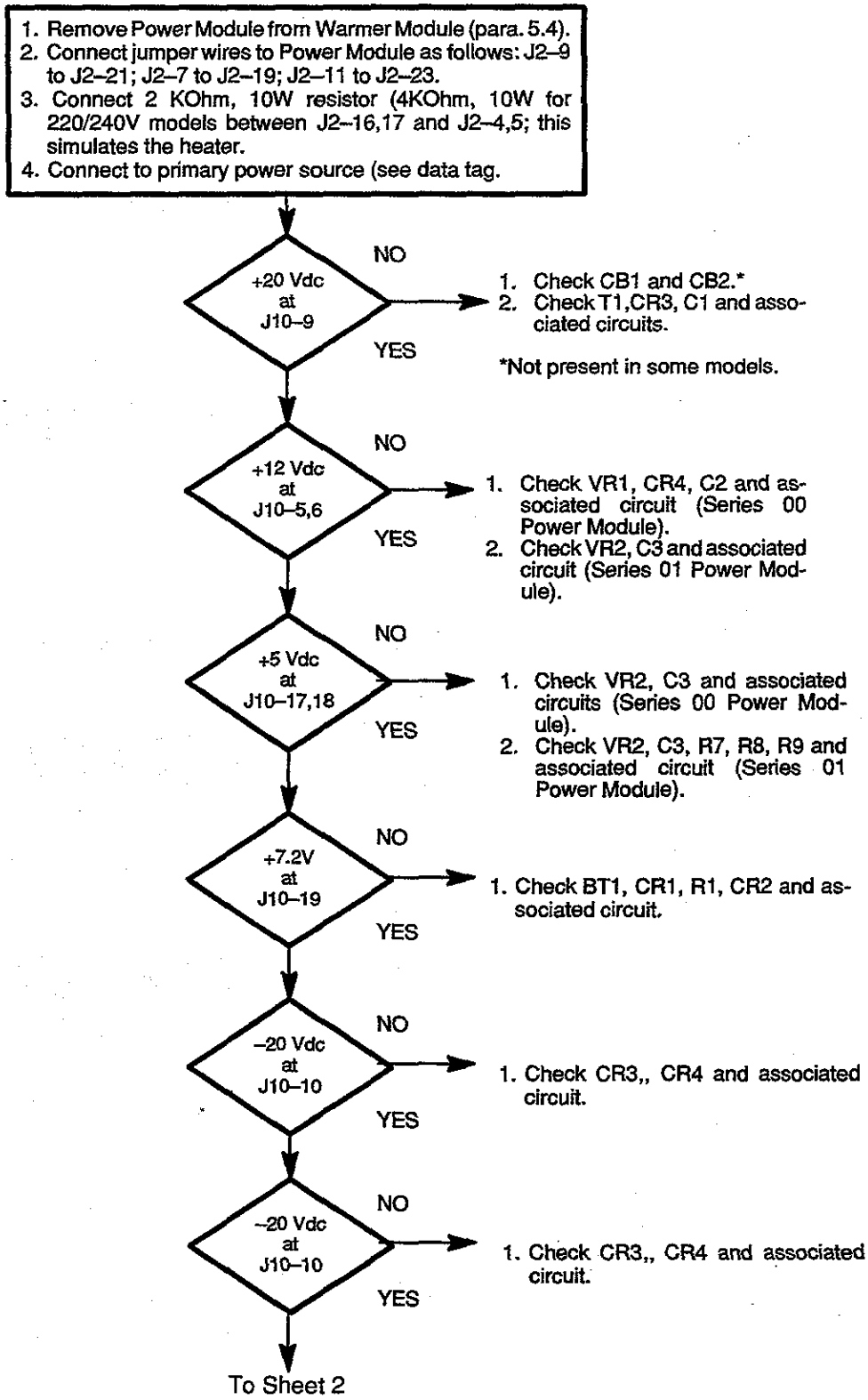
FLOWCHART 5.2 WARMER MODULE TROUBLESHOOTING

(Sheet 1 of 2)



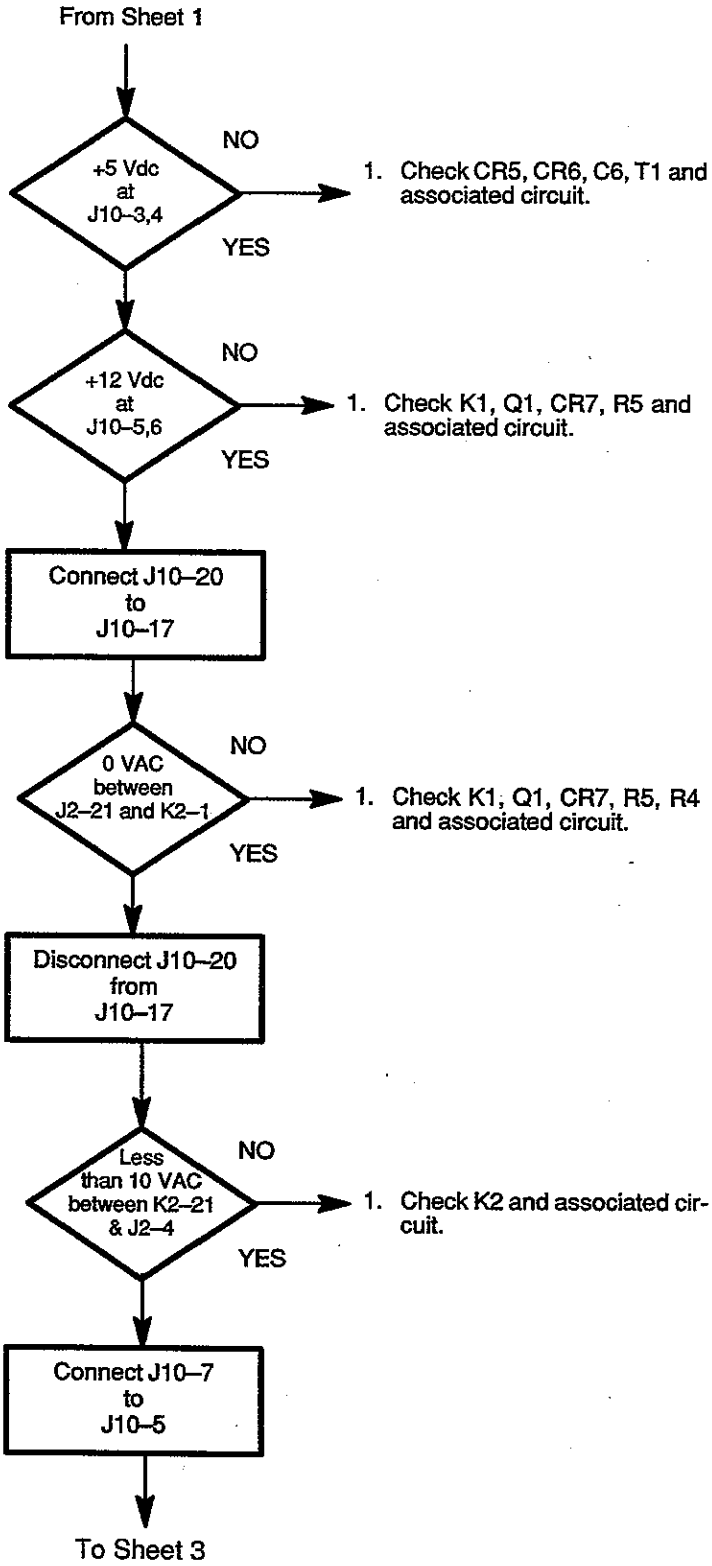
FLOWCHART 5.2 WARMER MODULE TROUBLESHOOTING

(Sheet 2 of 2)


1. Remove Power Module from Warmer Module (para. 5.4).
2. Connect jumper wires to Power Module as follows: J2–9 to J2–21; J2–7 to J2–19; J2–11 to J2–23.
3. Connect 2 KOhm, 10W resistor (4KOhm, 10W for 220/240V models between J2–16,17 and J2–4,5; this simulates the heater.
4. Connect to primary power source (see data tag.
+20 Vdc at J10–9
NO
1. Check CB1 and CB2.*
2. Check T1,CR3, C1 and associated circuits.
YES
*Not present in some models.
+12 Vdc at J10–5,6
NO
1. Check VR1, CR4, C2 and associated circuit (Series 00 Power Module).
2. Check VR2, C3 and associated circuit (Series 01 Power Module).
YES
+5 Vdc at J10–17,18
NO
1. Check VR2, C3 and associated circuits (Series 00 Power Module).
2. Check VR2, C3, R7, R8, R9 and associated circuit (Series 01 Power Module).
YES
+7.2V at J10–19
NO
1. Check BT1, CR1, R1, CR2 and associated circuit.
YES
–20 Vdc at J10–10
NO
1. Check CR3,, CR4 and associated circuit.
YES
–20 Vdc at J10–10
NO
1. Check CR3,, CR4 and associated circuit.
YES
To Sheet 2

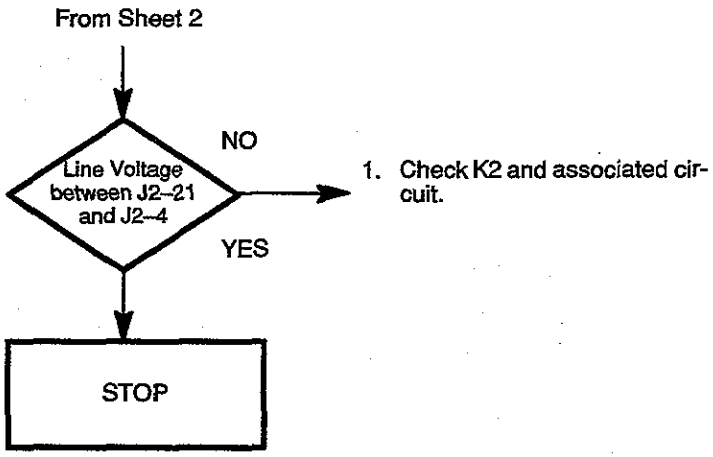
FLOWCHART 5.3 POWER MODULE TROUBLESHOOTING

(Sheet 1 of 3)



FLOWCHART 5.3 POWER MODULE TROUBLESHOOTING

(Sheet 2 of 3)



FLOWCHART 5.3 POWER MODULE TROUBLESHOOTING

(Sheet 3 of 3)

5.4 REMOVAL AND REPLACEMENT PROCEDURES

NOTE: Unless otherwise indicated, these procedures apply to all equipment covered in this manual.

5.4.1 GENERAL

This section provides removal and replacement procedures for components of the equipment. Removal and replacement procedures for components other than those provided are obvious upon inspection.

5.4.2 POWER MODULE REMOVAL AND REPLACEMENT

1. **DISCONNECT THE POWER CORD** from the Power Module (1).
2. **REFER TO FIGURE 5.1** and remove the two mounting screws (5) and washers (6) from the Power Module and carefully pull the Power Module out of the Warmer Housing (2) far enough to disconnect the interconnecting ribbon cable (3) from connector J10 (4) on PCB1.
3. **REMOVE THE POWER MODULE** from the Warmer Housing.
4. **TO REPLACE THE POWER MODULE** reverse the above procedure.

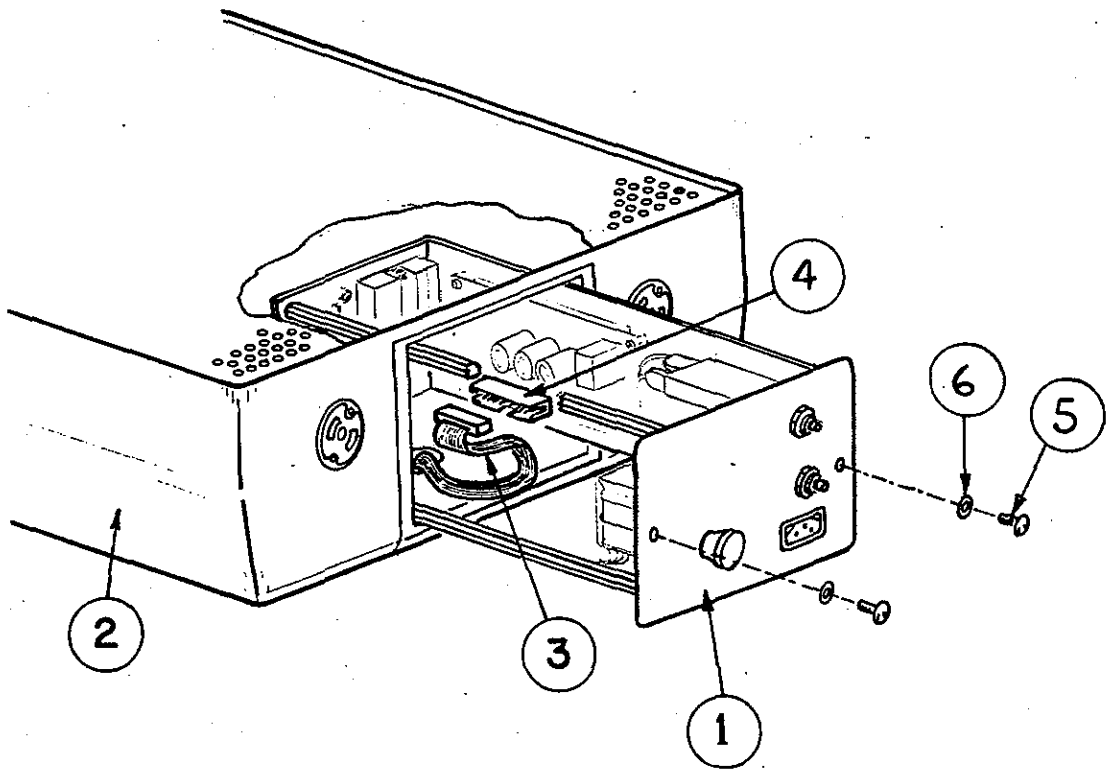


FIGURE 5.1 POWER MODULE REMOVAL AND REPLACEMENT

5.4.3 CONTROLLER MODULE REMOVAL AND REPLACEMENT

1. **REFER TO FIGURE 5.2** and remove the two mounting screws (1) and lock washers (3) that secure the Controller to the Mounting Post and unmount the Controller.

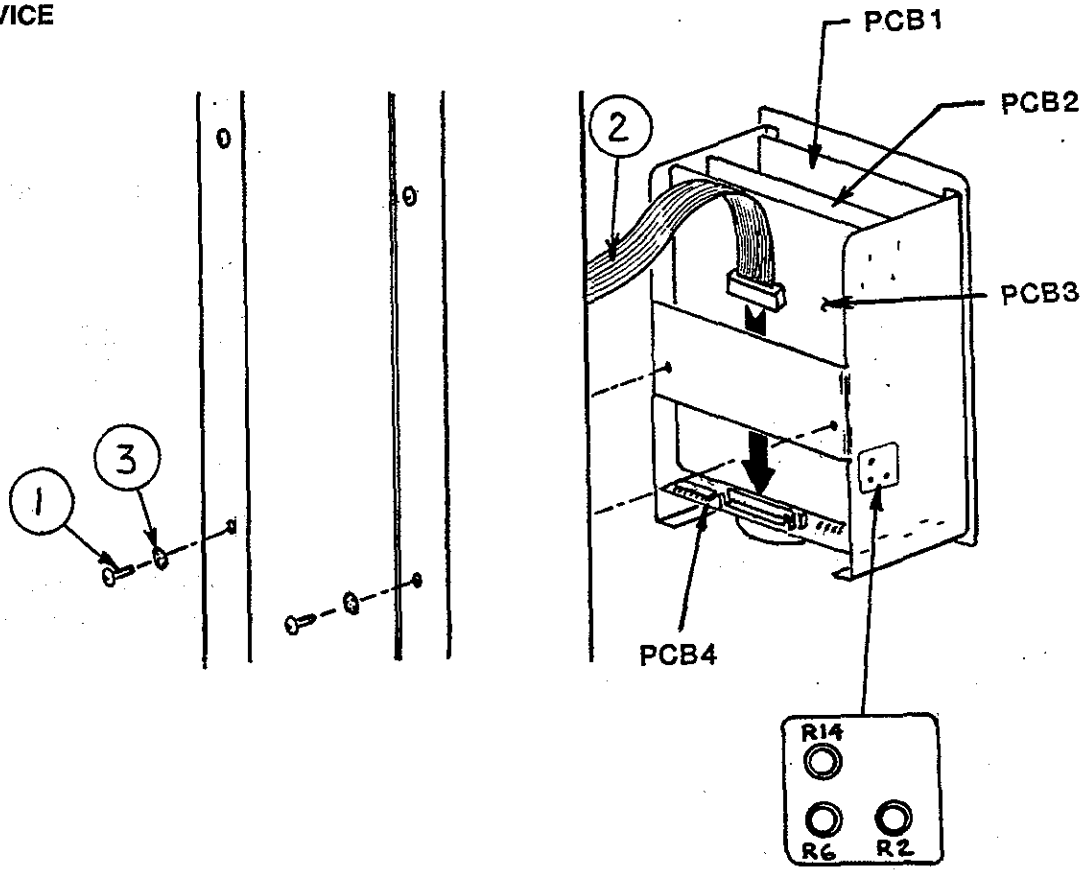


FIGURE 5.2 CONTROLLER MODULE REMOVAL AND REPLACEMENT,AND ADJUSTMENT AND CONNECTION POINTS

2. **DISCONNECT THE INTERCONNECTING RIBBON CABLE (2)** from connector J4 on PCB4 and remove the Controller from the Mounting Post.

3. **TO REPLACE THE CONTROLLER,** reverse the above procedure.

5.4.4 MOUNTING POST TRIM STRIP REMOVAL AND REPLACEMENT

NOTE: This procedure applies to the Infant Intensive Care System only. To remove the Trim Strip from the Wall Mounted Infant Intensive Care System, it will be necessary to remove the Warmer Module and Controller (paragraph 2.2.4) and the Oxygen Delivery Manifold Assembly (if one has been installed). The Trim Strip can then be removed by sliding it out through the top opening in the Mounting Post.

1. **REFER TO FIGURE 5.3.** Loosen (do not remove) the four screws (1) securing the Instrument Tray Support (2) to the Bassinet Support (3) and pull the support back as far as it will go (approx. 1/4 inch).

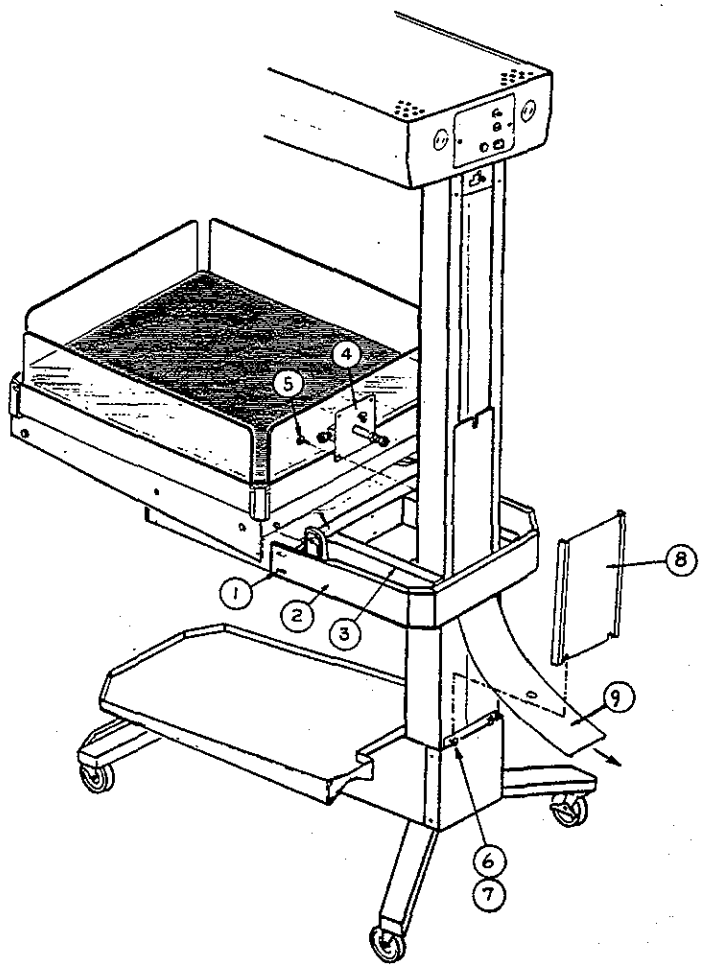


FIGURE 5.3 MOUNTING POST TRIM STRIP REMOVAL AND REPLACEMENT

2. **IF AN OXYGEN DELIVERY MANIFOLD ASSEMBLY (4) HAS BEEN INSTALLED,** remove the four screws (5) that secure the assembly to the front of the Mounting Post and temporarily remove the assembly from the post.

   NOTE: If an oxygen hose is connected to the Manifold Assembly, it will be necessary to disconnect the hose before the assembly can be removed.

3. **LOOSEN THE TWO SCREWS (6) AND LOCK WASHERS (7)** that fasten the rear cart cover (8) to the Cart and remove the cover and two corner trim angles.

4. **SLIDE THE PLASTIC TRIM STRIP (9)** down and off post and the two corner trim angles.

5. **TO REPLACE THE TRIM STRIP,** reverse the above procedure.

5.4.5 I.V. POLE AND MONITOR SHELF (ACCESSORIES) MOUNTING BRACKET REMOVAL AND REPLACEMENT

1. **REMOVE THE MOUNTING POST TRIM STRIP** (refer to paragraph 5.4.4).

2. **REFER TO FIGURE 5.4** and remove the two screws (1), flat washers (2), and lock washers (3) that secure the mounting bracket (4) to the mounting post and remove the mounting bracket.

3. **TO REPLACE THE MOUNTING BRACKET,** reverse the above procedure.

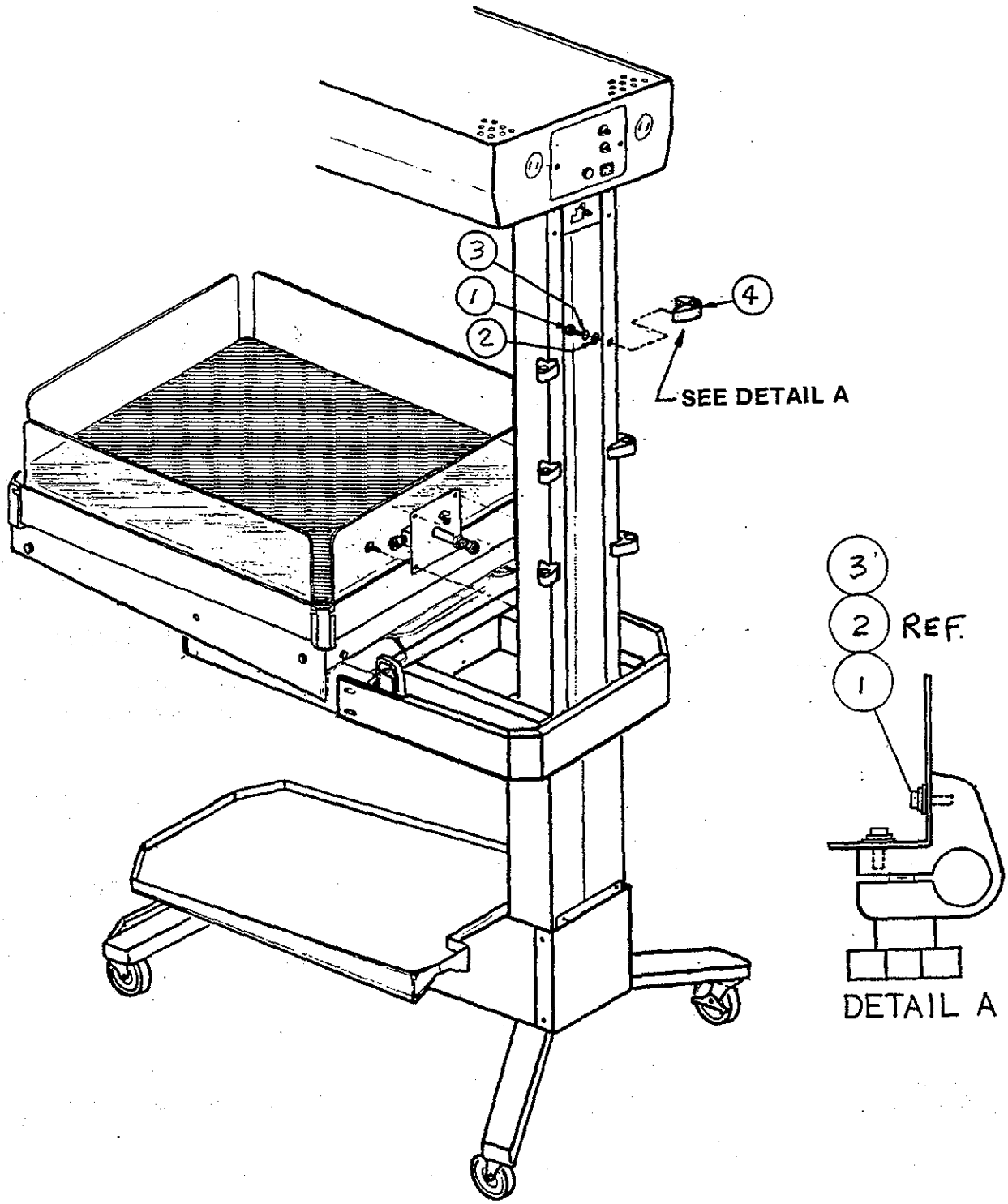


FIGURE 5.4 MOUNTING BRACKET REMOVAL AND REPLACEMENT

5.4.6 QUARTZ HEATING ELEMENT REMOVAL AND REPLACEMENT

IMPORTANT: The Quartz Heating Element may be removed and replaced without disassembling the Warmer Module.

> **WARNING: To avoid touching any hot surfaces, the Warmer Module should be turned off for at least 30 minutes before starting this procedure.**

1. **REFER TO FIGURE 5.5**, view A, and loosen (do not remove) the mounting screw (1) that secures the curved reflector (2) to the heater support bracket.
2. **RAISE THE CURVED REFLECTOR** up to release it from the mounting screw and slide it toward the opposite end of the reflector assembly to release the curved reflector for removal.

   NOTE: On early production models, it may be necessary to rotate the curved reflector slightly so that it will pass through the keyhole opening in the parabolic reflector.

CAUTION:

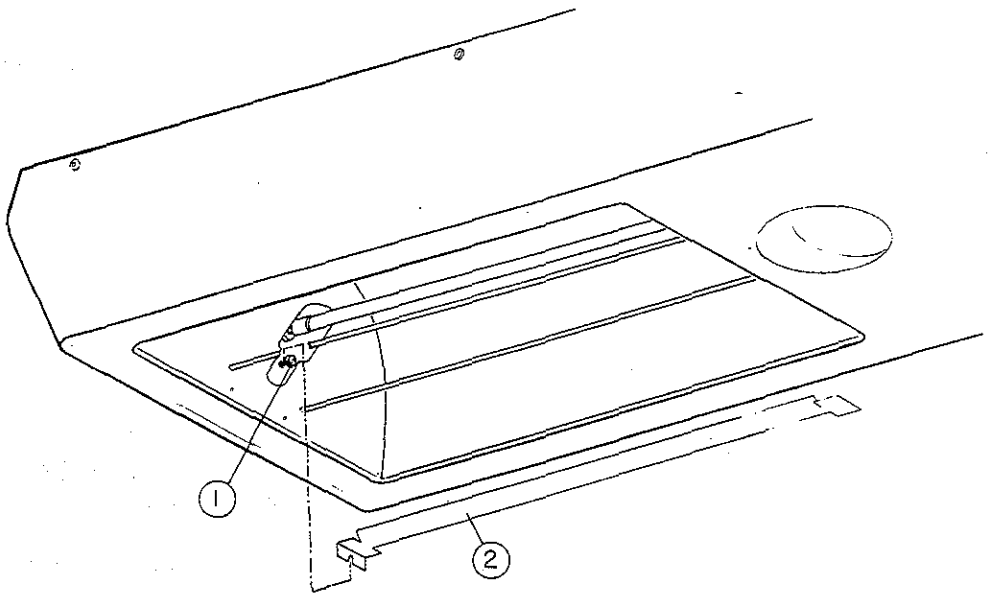
- **The Quartz heating element is a fragile component; handle with care to prevent damage.**
- **Do not handle the heating element with bare hands; skin oils may cause damage to the quartz heater. Use clean, lint–free cloth gloves or similar hand covering. If skin contact with the heater occurs accidentally, clean it thoroughly with alcohol before reinstalling.**

3. **REFER TO FIGURE 5.5**, view B. Grasp the heating element (3) with both hands and push firmly toward the front of the Warmer Module to release the rear end of the heating element from the rear spring–loaded connector (4). Maintain this pressure while lowering the rear end of the heating element until it is removed from this parabolic reflector. Carefully withdraw the front end of the heating element from the front end spring–loaded connector; remove the heating element.
4. **INSTALL THE REPLACEMENT HEATER** element by reversing the above procedure.

IMPORTANT:

- When installing the replacement heater element, it is important that it be inserted at an angle as shown in Figure 5.5, view B. Insert one end and seat it firmly into the spring–loaded connector and then, in one motion, raise the other end and insert it into the spring–loaded connector at the opposite end.
- When installing the replacement heating element, it may be necessary to bend the tabs (5) in the connector opening slightly to provide adequate clearance in the connector opening.

NOTE: It should be noted that later production units have an oval shaped connector opening in the reflector to provide for easier installation of the heating element.



VIEW A

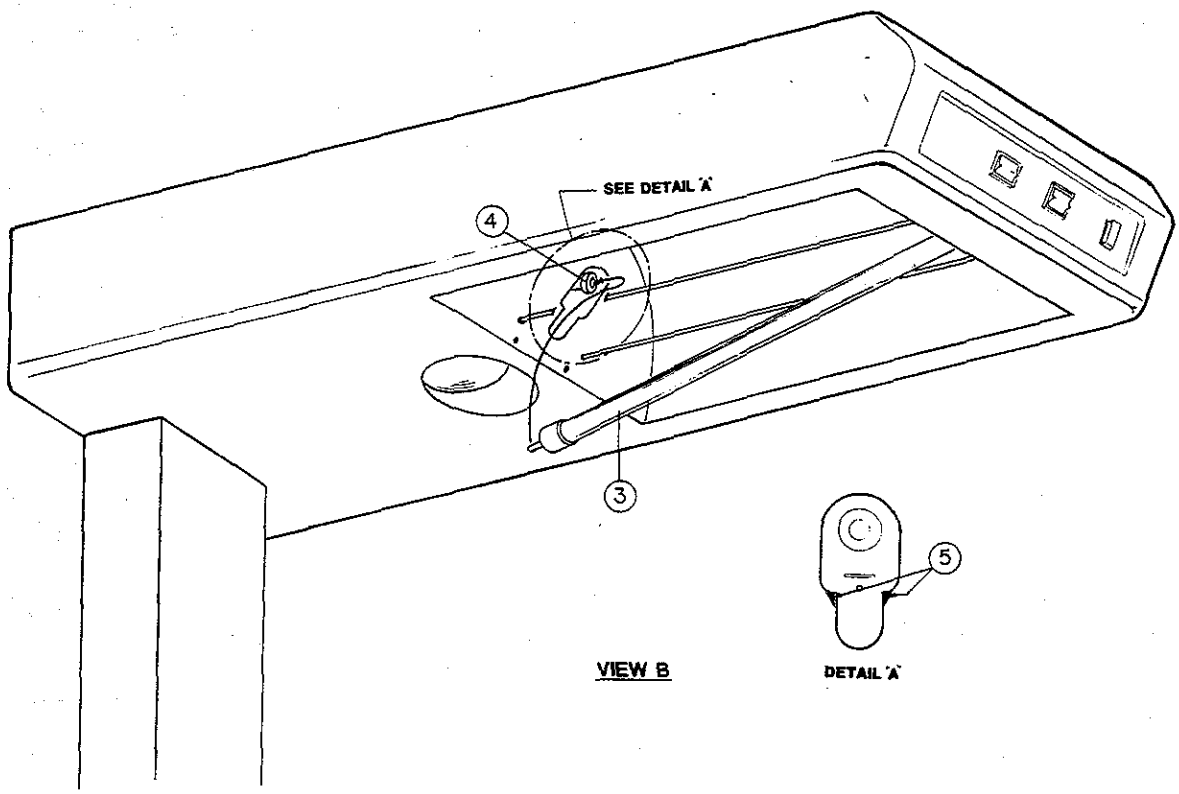


FIGURE 5.5 QUARTZ HEATING ELEMENT REMOVAL AND REPLACEMENT

5.4.7 EXAMINATION LIGHT REMOVAL AND REPLACEMENT

1. **REFER TO FIGURE 6.10.** Remove the eight screws (30), lock washers (34), flat washers (33), that secure the Warmer Top screen (12) to the Warmer Assembly and remove the screen.

2. **REFER TO FIGURE 5.6** and unplug the connector (4) from the lamp (3).

3. **REFER TO FIGURE 5.6** and loosen (do not remove) the two screws (1) that secure the lamp mounting bracket (2) to the Warmer Module Subassembly and remove the lamp mounting bracket and lamp. Use care to ensure that the window glass (5) is not dislodged during removal.

4. **REMOVE THE LAMP** from the bracket.

   CAUTION: When replacing the lamp, do not touch the conical inside portion of the lamp; damage to the lamp may result.

5. **TO REPLACE THE EXAMINATION LIGHT,** reverse the above procedure.

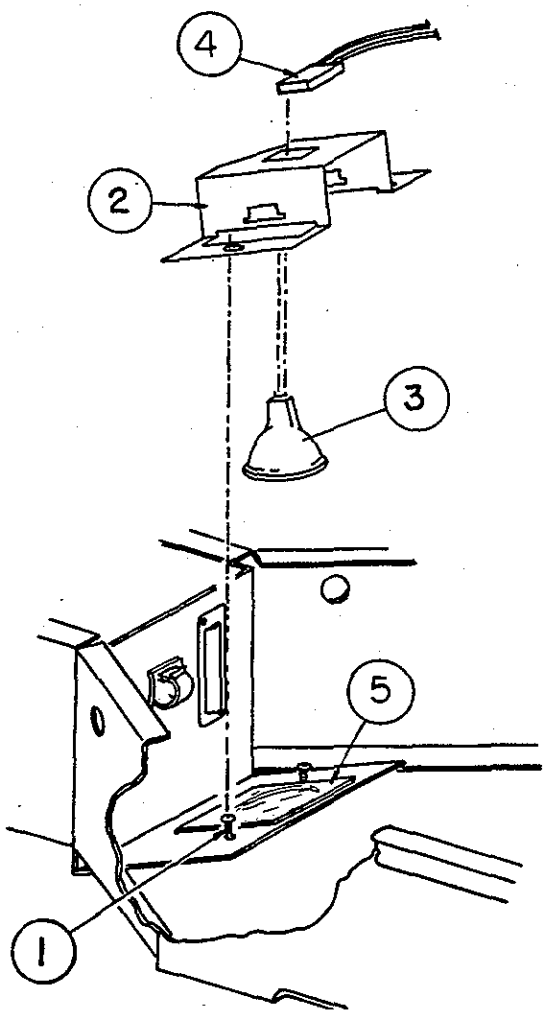


FIGURE 5.6 EXAMINATION LIGHT REMOVAL AND REPLACEMENT

5.4.8 HEATER/REFLECTOR ASSEMBLY REMOVAL AND REPLACEMENT

- INFANT INTENSIVE CARE SYSTEM
- WALL MOUNTED INFANT INTENSIVE CARE SYSTEM
- WALL MOUNTED INFANT WARMER

1. **REMOVE THE WARMER MODULE AND CONTROLLER** by reversing the procedure given in paragraph 2.2.4. (2.5.3 for Wall Mounted Infant Warmer.)
2. **REMOVE THE POWER MODULE** from the Warmer Module using the procedure given in paragraph 5.4.2.
3. **REFER TO FIGURE 6.10.** Disconnect the ground wire (16) from the post mounting pivot bracket (5), remove the retaining ring (11) and slide the pivot bracket off the warmer mounting pivot bracket (2).
4. **REMOVE THE SIX SCREWS (29)** and nylon finishing washers (32) that secure the Warmer Hood (4) to the Warmer Module Subassembly (1) and remove the hood.
5. **REMOVE THE FOUR SCREWS** (28) that secure the heater/Reflector Assembly (3) and remove the assembly; disconnect the heater wires at each end.
6. **TO REPLACE THE HEATER/REFLECTOR ASSEMBLY,** reverse the above procedure.

5.4.9 HEATER/REFLECTOR ASSEMBLY REMOVAL AND REPLACEMENT

- FREE STANDING INFANT WARMER

1. **REMOVE THE WARMER MODULE AND CONTROLLER** by reversing the procedure given in paragraph 2.3.3.
2. **REMOVE THE POWER MODULE** from the Warmer Module using the procedure given in paragraph 5.4.2.
3. **REFER TO FIGURE 6.15.** Remove the six screws (21) that secure the Warmer Hood (4) to the Warmer Module Subassembly (1) and remove the Hood.
4. **REMOVE THE FOUR SCREWS** (20) that secure the Heater/Reflector Assembly (3) and remove the assembly; disconnect the heater wires.
5. **TO REPLACE THE HEATER/REFLECTOR ASSEMBLY**, reverse the above procedure.